THE FOUNDRY

Volume 53
Number 11

CLEVELAND, OHIO, JUNE 1, 1925

Published
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Castings Transform Forest Trees to Paper

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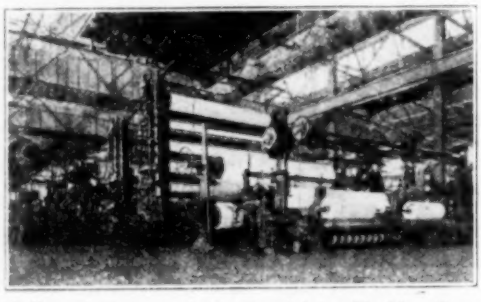

Rolls and Frames of the Fourdrinier Machine Come From the Foundry

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Find Where Castings Can Be Sold

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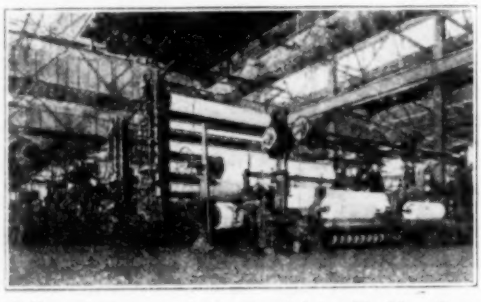

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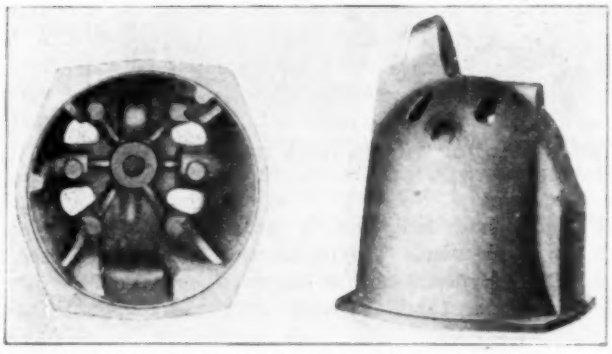
Selling Permanent Mold Castings *Demands Time and Patience*

By Pat Dwyer

NINE months of steady, persistent, expensive and at times discouraging experimental work was what the Permold Co., Cleveland had to go through before the first successful casting was delivered on an initial order for 50,000 received from a manufacturer of vacuum cleaners. That was several years ago and millions of castings of one kind and another have been made since that time. Experience gained in the first memorable instance and additional experience secured from the production of a long line of varied castings in recent years places the company in a position where it can quote confidently both on prices and delivery dates.



THIS HOUSING FOR A VACUUM CLEANER PRESENTS SEVERAL NICE PROBLEMS IN PERMANENT MOLD DESIGN

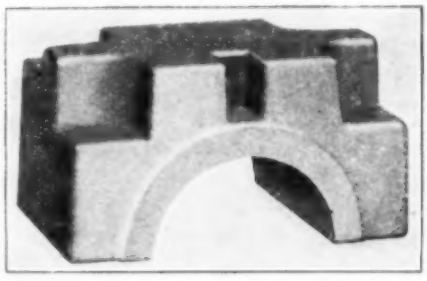
Probably every foundryman at one time or another in his career has dallied with the idea of making castings in a mold fabricated from a more stable material than sand. Many of those who have been in a position to follow their inclination and have done some experimental work, quickly learned that the process in many respects bears a startling resemblance to the poison ivy plant. A depleted bank account leaves wounds on the spirit as deep and painful and usually more lasting than those inflicted on exposed parts of the body by the beautiful plant which appears so harmless.

To those who are not foundrymen and who, therefore, are completely ignorant of every feature connected with the commercial production of castings, some form of permanent mold suggests itself as the simplest and most logical medium for doing the work. They are happily unaware of the great fundamental laws of nature which govern expansion and contraction of metals under varying temperatures. To them metal is metal and a mold is a mold. In their innocence they assume that any form of casting may be produced in a metal mold as readily as lead bullets at one time were made by the owners of the old muzzle loading muskets.

Hazy notions regarding the production of aluminum castings in permanent molds are not confined to the general public. Ignorance in various degrees from partial to absolute prevails even among foundrymen perfectly familiar with all details of the process involved in the production of castings in sand molds.

Different Methods

They know that an immense quantity of aluminum and other white metal castings are made successfully in metal molds and include them all under the comprehensive title die castings. Even then in many instances they are not sure whether the metal is spilled into the mold in a molten condition, or simply heated and forced into shape like a drop forging or any one of the numerous pieces formed under a punch press. For the benefit of any who may be interested and who are not familiar with the subject, it may be stated that four distinct methods are in commercial use at present for the production of nonferrous castings in metal molds. Each one presents certain advantages under a given set of conditions. Also each one has its limitations and in many instances cannot compete with the old, standard sand casting process. They are known respectively as pressure die casting, Gothias, slush mold and permanent mold methods. The radio and the automobile largely have been responsible for the present immense development of the pressure die casting industry. Castings made by this method are divided into two general classes, those produced in dies where the metal is forced in under pressure that varies from a few ounces to 35 pounds and a second class in which the pressure employed may be any where between 50 and 1000 pounds.

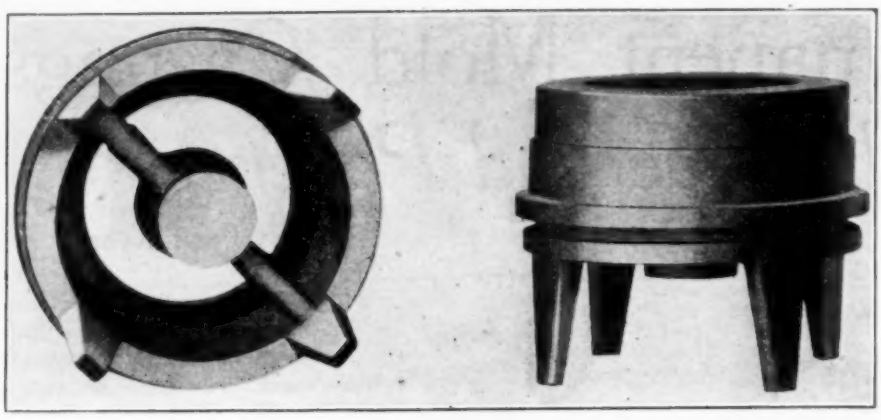


METAL IN A BEARING MUST BE HARD AND SOLID

Die castings have been made successfully from tin, lead, zinc and aluminum base alloys. To a limited extent they have been made in brass. Alloys with a tin base to the extent of about 90 per cent fuse at 450 degrees Fahr. and show a tensile strength of about 8000 pounds per square inch. Lead base alloys have a higher melting point and practically the same tensile strength. Zinc alloyed with tin and copper, or with tin and aluminum melts at 780 degrees Fahr., and will develop from 16,000 to 35,000 pounds tensile strength per square inch. Tensile strength of the aluminum base alloys ranges from 18,000 to 21,000 pounds per square inch. Accuracy to within 0.001-inch is possible with die castings made from tin and lead. Zinc and aluminum castings can be held to a limit of 0.002 to 0.004-inch per inch of length.

Inserts of steel, bronze or other metals may be placed in die castings. They are not held in the casting by fusion but by shrinkage contact with suitable lugs, openings or brackets provided on the inserts for the purpose.

In a second method known as the Gothias method the metal also is forced into the mold under pressure but in a different manner from that employed in die casting. A definite quantity of metal is poured into a metal mold and then a plunger is introduced in a suitable manner depending on the shape of the mold. The plunger forces the metal under pressure into all parts of the mold. This method is used more extensively



THE HEAVY BEARING BOSS IN THE CENTER OF THE CASTING MUST BE COOLED BEFORE THE THIN SUPPORTING RIBS SOLIDIFY

abroad than it is in the United States.

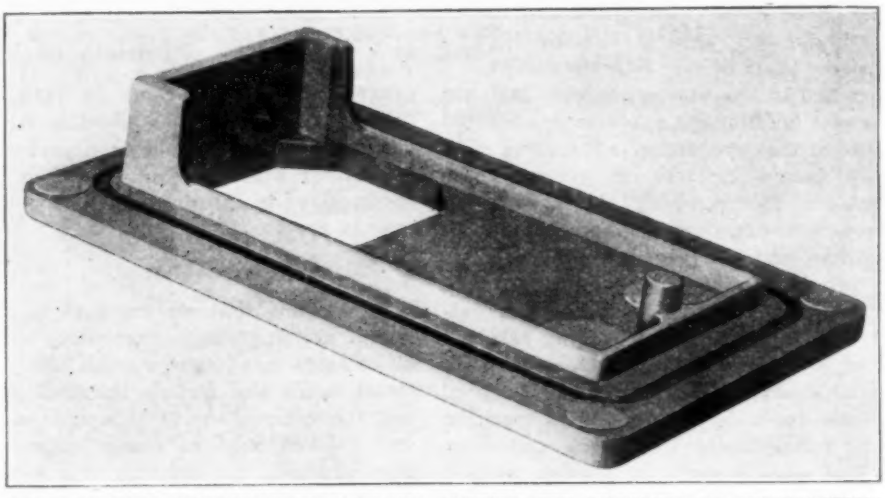
Slush casting is the term applied to a widely applied process for making hollow castings, mostly of an artistic character, in white metal. The mold is made of bronze in several sections so that it may be removed readily from the finished casting and then reassembled in position for pouring. The mold is filled completely with molten metal through a suitable opening. The metal is allowed to set for a definite time depending on the size of the casting and the desired thickness of the walls. When the operator decides this point has been reached he inverts the mold and spills all the metal which still remains molten into a ladle by which it is transferred back into the open melting pot from which the mold is supplied. The shell of metal which solidifies in contact with the walls of the mold forms the casting.

Each of the foregoing may be referred to properly as permanent mold processes, since in each case a metal mold is employed to produce an immense number of duplicate castings. However, in the interest of accuracy the term permanent mold only applies to a hot metal mold into which metal, usually aluminum, is poured from a hand ladle as in ordinary foundry practice. This distinction is perfectly apparent and is observed by all who are familiar with the subject, but outside this number, as previously stated, general knowledge seems to be diluted with misconception almost to the vanishing point.

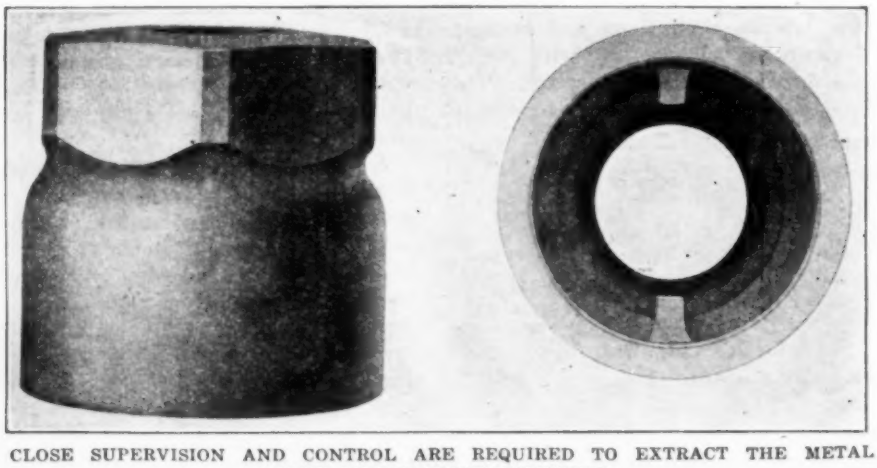
Quality of Castings

Under certain conditions and for certain castings no method or mold yet devised can replace or rather supplant the old established method of pouring the metal in a sand mold. This applies particularly to extremely complicated small castings and to large castings. Sometimes a permanent mold might be perfectly feasible mechanically and metallurgically, but not economically. The initial cost of the mold has to be absorbed in the total number of castings produced and naturally there is a minimum limit. A customer might well hesitate a long time before investing in a $400 mold to make half a dozen 2-pound castings.

Disadvantages of sand castings are inherent in the process by which they are made. Sand at best is not a stable material, it is dislodged easily from the gates or the face of the mold and forms sand inclusions in the casting. Cores are subject to variation both in size and in position. A slight difference in ramming the sand in the mold or in rapping the pattern or even the speed observed in pouring the metal will be reflected in a variation in size between several castings made from the same pattern equipment. Steam generated when hot metal comes into contact with wet or hard sand causes blowholes, unsoundness and porosity. To offset this, only a limited pattern equipment is required and the cost of producing one or a small number of castings is not excessive.



EVEN IN THIS COMPARATIVELY PLAIN CASTING THE PROBLEM OF CONTRACTION ENTERS TO COMPLICATE OPERATION



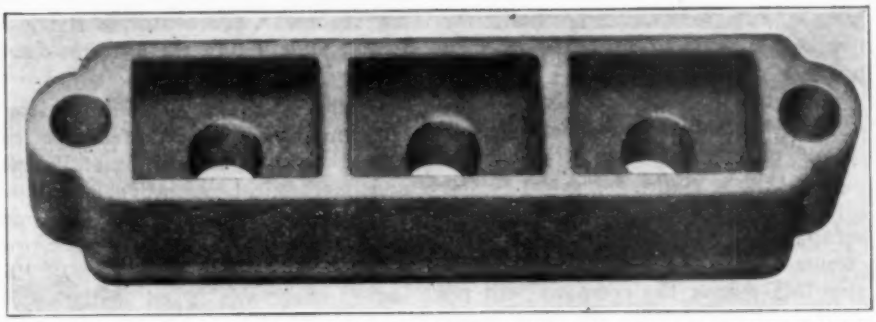
CLOSE SUPERVISION AND CONTROL ARE REQUIRED TO EXTRACT THE METAL CORE AT THE PROPER MOMENT

Usually, die castings are more accurate than plain permanent mold castings but occasionally even these castings are not sufficiently accurate without subsequent machine operation. Under these conditions the die casting method presents no advantage over the permanent mold process. The equipment for making die castings is much more expensive than permanent mold equipment for the same castings. However, as a compensat-

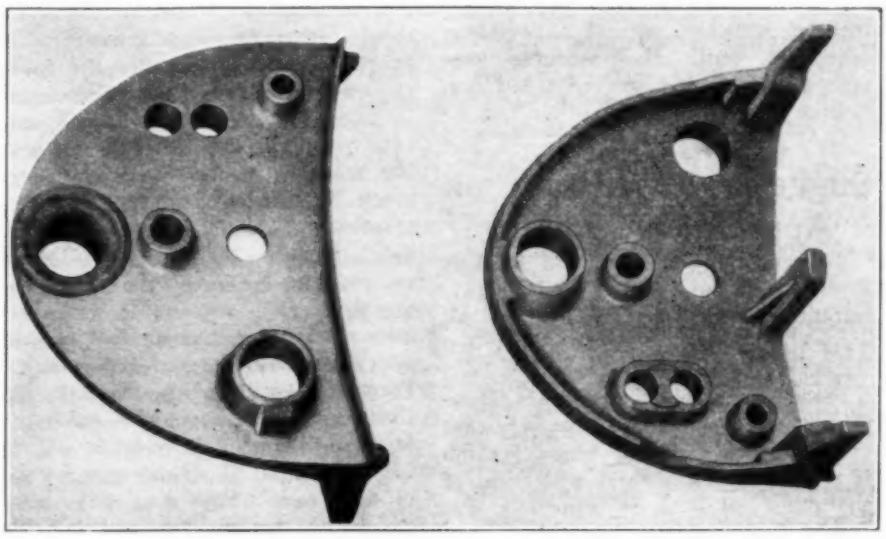
ing feature the castings can be made more rapidly by the first than by the second method.

In speed of production and cost of equipment, the permanent mold occupies a position about midway between the sand and the die casting method, but the product serves a field not covered by either of the others.

Following are some of the claims set forth by the Permold Co., Cleveland, which has built up an extensive business in this particular branch of the foundry industry: Castings are free from blowholes and porosity. This insures a freedom from leakage of gas or liquid under pressure. Castings are free from black spots and pin holes and the smooth clean surface easily is polished. Castings are relatively accurate in dimensions and require little or no machining. Each one being a duplicate of the others and fitting readily into any machining jigs or fixtures that may be necessary.



ON ACCOUNT OF ITS SHAPE AND UNIFORM THICKNESS OF METAL THIS CASTING WAS EASILY MADE BY THE PERMANENT MOLD PROCESS



SHRINKAGE AND CONTRACTIONS STRAINS WERE THE PRINCIPAL FEATURES TO BE OVERCOME IN DESIGNING A MOLD FOR THESE CASTINGS

Castings are stronger and more ductile.

In addition to the foregoing, attention is directed to the fact that the permanent mold process is continuous, no flasks to shake out and no sand to be reconditioned. The output per man, per day is greatly in excess of what may be accomplished with sand molds. Direct production labor cost is proportionally lower after the initial cost of the mold has been absorbed, but the cost of technical supervision is much greater.

Selling methods connected with permanent mold castings differ to some extent from those pursued in disposing of castings made by other methods, particularly by the sand mold method. In soliciting new accounts stress is placed on the following factors: Accuracy, strength and homogeneity of the metal, rapid delivery after the mold equipment is made, competitive cost per piece depending on the total cost of the mold. A fairly simple mold will cost from $200 to $500 and that is the reason the process is applicable only where the number of castings required runs into the hundreds and preferably thousands. Under exceptional circumstances orders have been placed for as small a number as 100.

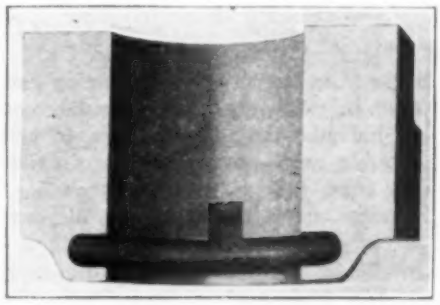
Close Grain Iron

Design of the mold is such an important factor that the Permold company insists on handling every detail of the job from start to finish. It maintains a staff of engineers, designers and metallurgists familiar with the advantages and limitations of the process. This staff works in collaboration to produce a mold that will meet any definite requirement.

Molds are cast from a close grain gray iron, similar in general respects to the iron used in molds for glass. Only perfect castings are accepted and the greatest care is exercised in the foundry where they are made to prevent blowholes, shrinkage strains or segregation. The success of the permanent mold process, to a great extent, depends on thermal conditions connected with both metals; the molten aluminum poured into the mold and the iron in the mold itself.

The basic principle on which the success of the permanent mold is dependent is control of heat radiation to insure uniform cooling of all parts of the casting. This effect is brought about partly by the shape of the mold and the thickness of the wall at various points and partly by the size, shape and position of the gate through which the metal is introduced into the mold. Although each of these agents is only partly responsible for successful results, both must synchronize in perfect harmony under actual operating conditions. The ideal condition is attained when the metal starts to solidify at one end and the solidification progresses steadily from that end to the opposite end where the runner is located. Theoretically the last part of the casting to set, should be that part in immediate contact with the gate. Successful practice closely approximates theoretical requirements.

From the foregoing it is apparent that many factors are involved in placing an order for permanent mold castings, that are not present where only sand molded castings are considered. The casting company insists on its exclusive privilege of making the mold according to a design approved by its technical staff. The customer may present a blueprint, a model or a



CLOSE CONTROL OVER THE GATING ARRANGEMENT AND THE TEMPERATURE OF THE METAL IS REQUIRED IN POURING THIS CASTING ON ACCOUNT OF THE VARYING THICKNESS AT DIFFERENT POINTS

sample, but the casting company will not accept a mold made by a third party.

So sensitive and so nicely balanced are all the features entering the process of making castings in permanent molds, that a slight difference in manipulation will produce nothing but scrap from a mold that under other circumstances, served satisfactorily. For this reason the company will not guarantee commercial castings unless it is allowed to design and finish the molds to fit its own requirements. Instances are on record where even molds made to its strictest specifications and operated under its fostering care, made nothing but scrap castings for a considerable period as instanced in the opening paragraph.

While the casting company insists on its right to make the mold, still the customer has to pay for the tool work in the same manner he would have to pay for a pattern if the castings were to be molded in sand. The casting company pays for the mold material and the casting company retains the sole right to make castings from it. It also repairs and renews the mold at its own expense.

The arrangement practically is on a par with that observed in commercial photography. The customer pays for the negative, he also pays for every print he receives, but the photographer holds the negative. The artist claims, and it is stated the claim has been upheld by the courts, that a form of tacit contract exists in which the party of the first part agrees to deliver as many photographs as the party of the second part is prepared to take. By satisfactorily filling this requirement the only really essential feature of the contract is observed. The patron may have subscribed an amount covering the cost of the negative, but that does not give him a right to the plate any more than it does to the camera or any other piece of equipment involved in the production of the picture.

Expensive Experimenting

The fact that the Permold Co. has more than doubled its production each year in permanent molds would seem to indicate that the process is both popular and commercially feasible. However, this represents a growth extending over a period of several years, the reward of a long, gruelling and uphill fight waged against conditions within and without the institution. Costly experimental work absorbed resources at an alarming rate, particularly at a time when customers were few and notoriously gun shy. Tentative confidence displayed in the placing of orders, frequently was strained to the limit before the castings finally were delivered.

Gradually the troubles were ironed out and this included features connected with financial, metallurgical and mechanical operation. The history of the institution is one more of the long list of instances that prove nothing succeeds like success. Each order that was filled satisfactorily meant another solid block in the foundation on which the superstructure finally was erected.

This company has attained prominence because it has succeeded, but no publicity is given to the many experimenters who have failed before and during the same period. Failure has been due principally to an underestimation of the difficulties of the problem. In some instances where this feature has been appraised at its true value, failure has been due to lack of sufficient capital to continue operation until the business was placed on a paying or even a self sustaining basis.

Suggests Discussion on Apprentice Training

The information contained in THE FOUNDRY on the different subjects pertaining to the foundry business always has been interesting and enlightening to the writer, who has been a reader for a number of years. However, there is one subject, namely that of apprentice training, which I think is not advancing abreast with most of the other subjects so generally discussed from time to time.

The writer has found that the foundry owners, who should be most interested in this particular subject, are the ones who are the least interested. The foundries that should try to keep some system or method to secure young men to learn molding are the jobbing foundries and the plants making heavy machinery castings. In these plants molding machines are at a minimum, due to the changing of patterns, size of patterns, quantity of castings required from the pattern, etc. These shops always will require a good percentage of skilled mechanics, and already are beginning to suffer from a scarcity of molders able to handle this class of work. The good molders, men who served their apprenticeship in this type of shop, are mostly old men today, and they are dropping off faster than they are being replaced by young men who have served their time in learning the trade.

Many of the men today, who claim they have worked four years at the business, are men who probably have worked in some foundry as laborers for a while, then were put on a molding machine and later made finishers of coresetters. When they go into a jobbing foundry, or a foundry making heavy machinery where the molds may not be made on a molding machine, they are lost in the woods. Still they call themselves molders and have the nerve to tackle such jobs, and cause many defective castings before the foundry foreman gets wise to them. Men who learn the art of molding in this way seldom become as sure, dependable mechanics as the boy or man who serves his apprenticeship and starts with the ABC of molding, as was done years ago.

The foundry manager or the superintendent cannot be blamed for this condition, because a system carried out properly to enable young men to learn the trade must have the sanction and assistance of the foundry owners. Today it is necessary to pay what seems like a high wage rate to apprentices learning the molding trade, it being impossible to get much in return for the first few months. This is the sticker. No provision is made to take care of this feature and as a rule the apprentices are kept on jobs where they can produce the greatest tonnage, and are not shifted around on different jobs, as should be the case when learning the trade. The owner pays in the long run, since the man is not the mechanic that he should be, and goes to some other shop to work as a full fledged mechanic.

In conversation with a foundry owner some time ago on this subject, the writer was given this answer: "Why should I spend time and floor space teaching boys the molding trade when they leave as soon as they are out of their time?" It is true that many do leave as soon as they have served their time, the reason being that they can get more elsewhere than is offered them in the shop where they learned their trade. However, it generally works out the same all over, boys serving their time in your shop leave and *vice versa*.

Therefore, foundries making castings that require skilled mechanics should get together and devise a system whereby the men in charge of the foundries would have no excuse for not teaching every apprentice the molding trade thoroughly as it was taught them years ago.

J. F. GAFFNEY
Toledo Machine & Tool Co.,
Toledo, O.

Managing Steel Foundries-I

By R. A. Bull

MAJOR BULL, director of the Electric Steel Founders' Research Group, prepared for the spring meeting of the American Society of Mechanical Engineers an unusual paper on management problems. The first portion of this paper is presented herewith and the remainder will appear June 15.

FEW realize the complexities which attend steel foundry operation and in this article a complete analysis of duties and responsibilities is given. The author gives his reasons for assigning certain latitude to certain executives.

INSPECTION should be free from domination by production schedules and promises of delivery. For this reason it is recommended that the inspectors shall be responsible to the plant manager or the head sales executive.

THE steel casting industry technically separates itself into several general divisions. The first of these is the open-hearth, which is the largest. Statistics credit the year 1917 with the greatest output of open-hearth steel castings produced in the United States, 357,700 net tons. Of this production, 54 per cent was basic and 46 per cent was acid. The second technical division of the industry from the standpoint of volume of output, is that of the electric furnace. Although electric steel castings were not produced in the United States until 1908, they have reached an annual total of 255,000 tons, approximately 16 per cent of all steel castings produced yearly in this country. Nearly all of the electric steel castings made in America are of acid metal, presenting in this respect a decided contrast with relation to the fairly equalized selection of acid and basic linings for open-hearth furnaces in the foundry.

The third technical division is that of the converter. The amount of steel castings produced from this unit reached the peak in 1918 when 180,000 tons were made. About that time the output of converter steel castings was approximately 1½ times that made from electric furnaces. At present the tonnage of converter castings is about a fourth that of electric steel castings.

The fourth technical division into which the industry has classified itself is that of the crucible. In 1912, there were 22,000 tons of crucible steel castings produced in this country. It is doubtful if at the present time any crucible steel castings are made in America, except in a few instances for home consumption of the product. From the standpoint of commercial distribution, this division now may be disregarded.

Considered from the standpoint of industrial grouping, steel casting manufacture divides itself in a different way from that just indicated. Three rather distinct classifications exist, as follows:

Open-hearth foundries, generally acid, producing steel castings of sections varying from medium to heavy, with overall dimensions covering a wide range.

Open-hearth foundries, generally basic, delivering a product principally consisting of repetition work in the nature of specialties for railroad use. Such castings are almost invariably of moderate sections, and only a few foundries making this product produce specialties having large overall dimensions. Most of the castings in this class are of average proportions.

Electric foundries, almost invariably acid, and converts foundries, always acid, generally specializing in castings of thin sections, and small or medium overall dimensions.

Comparing the average size open-hearth foundry with either the electric steel or converter foundry as commonly found, there are great differences, aside from melting units and other equipment. The distinctions are magnified in the cases of the largest open-hearth foundries and the smallest electric steel or converter foundries. Many of the characteristics distinguishing each of the two general types are unrelated to the large differences in average tonnages produced in them.

Thus it will be apreciated that managerial methods should be considered with relation to the type of steel foundry under consideration. In this, as in other industries, fundamental principles may be applied effectively, irrespective of size of output or kind of foundry. Further, many details are significant only in the division into which the plant naturally falls. In no other branch of industry do the regular operations create as heavy a demand as is made by the steel foundry, upon the combined knowledge of the mechanical engineer, the metallurgical engineer, the chemist, the physicist, and the experienced manager of men. One important division of steel casting work leans heavily on the creations of the expert electrical engineer, to supplement the list of technical and scientific requirements. Many engineers have an inadequate appreciation of the complexities of the steel casting industry, presenting management problems caused to a large extent by the many skilled operations required. A factor, of great significance in the manufacture of steel castings, is the relative importance of the personal equation. Labor costs represent approximately half of the total costs of making steel castings.

Some persons, including industrialists, distinguish between skilled and semiskilled occupations by making the following classifications: Trades that are most commonly known to the average man, each of which has relatively large numbers of craftsmen; and occupations, the extent of which does not require many workmen, or the nature of which is not familiar to the average citizen who is apt to consider a skilled trade as one that is wholly or partly unionized. The author wishes to make the point that many skilled trades are erroneously regarded as semiskilled, due to unfamiliarity of many persons with the work involved. It requires much more skill to be a thoroughly competent operator of a pneumatic chipping hammer in a steel foundry than many engineers realize, and probably more skill than is displayed by the average carpenter or bricklayer.

The foregoing explanation makes clear the significance of the following list of occupations ordinarily found in the modern steel foundry, requiring men for performance only and not for direction. The complex-

ity of the problems requiring solution by the engineer-manager will be appreciated. Employes such as timekeepers, piece-work checkers, and those doing clerical work only, are excluded from the list:

Blacksmiths
Blasters
Carpenters
Casting chasers for order department
Casting checkers for samples, gaging, etc.
Chippers
Coremakers
Crane runners
Cutting torch men
Electricians
Grinders
Laboratory assistants
Ladle liners and dryers
Machinists
Melters and furnace helpers
Millwrights
Molders
Oven-tenders Heat-treating, mold and core
Wood and metal patternmakers
Pattern storage tenders
Sand mill operators
Scale tenders
Sprue-cutters
Steel-pourers
Straightening press men
Welders

These occupations are typical in the average large or small steel foundry where patterns are constructed on the ground, where there is a regular gang of maintenance men, and where castings having satisfactory surface appearance are produced.

Supplementing the list of typical occupations, we will enumerate a few important tasks at which additional experienced men must be engaged in the larger open-hearth foundries. These are:

Bricklayers
Boiler plant firemen
Charging machine operators
Locomotive engineers
Locomotive firemen
Pipe fitters
Stationary engineers
Switchmen

In any steel casting plant there are other men employed at occupations in each of which the work can be done satisfactorily only as the result of careful instruction and considerable experience. Some of these are as follows:

Chainmen for cranes
Gagger and core-rod straighteners
Shake-out men
Shipping room attendants
Storeroom attendants
Tumbling barrel tenders
Wood and metal flask tenders and repairers

Classify Departments

It may be appreciated that the work of running a steel casting plant should be organized and directed with special care. This leads to a consideration of the division of responsibilities and the co-ordination of departments in a steel foundry, operated by men who have headquarters where the product is made.

The first group to be considered is what might be termed the staff organization, the members of which report directly to the principal company executives, or to related staff departments. The sections regarded by the author as coming under this general heading are as follows:

Sales
Accounting
Purchasing
Cost
Drafting
Order or schedule
Research
Metallurgical
Inspection
Construction
Service

Probably there will be little disposition to criticize most sections of the listings given. Some might disagree with the assignment of certain departments to the group that should be governed by the principal executives. It is appropriate to enumerate reasons for some of the author's preferences. The inspection of the product is a detail that sometimes is given to the superintendent to direct. If the chief inspector reports to the shop superintendent, the author believes a hazard is unwisely assumed that may react to the disadvantage of the consumer, and ultimately to the producer.

The up-to-date steel foundry is operated on the principle that the interests of the buyer and the seller are mutual. Sometimes it is extremely difficult to decide whether a steel casting should be scrapped or shipped after further treatment. It is impossible to prepare general or specific instructions to cover many points daily requiring decision in the conscientious inspection of steel castings. The proposition largely resolves itself into the exercise of good judgment. For this a practical knowledge of the use to which the casting would be put often is required. In the necessity for making fine distinctions between what is good enough to use and what is bad enough to discard, an employe working under the direct authority of the shop superintendent must reflect the latter's judgment in general. He must do what his superior definitely instructs him to do with respect to a particular casting. The superintendent frequently is under pressure to get the largest possible output at the lowest possible cost. Sometimes the demand for high quality is coupled with these requirements. The three things cannot always be done at the same time. The desire to do them and thus gratify the management may, consciously or unconsciously, influence the man under fire. The result may be inadequate consideration for the customer's requirements, and for the reputation of the foundry.

The only practical safeguard against the exercise of poor judgment in the examination of castings for shipment in the author's opinion, is to place the chief inspector completely under the jurisdiction of a company executive, who is not as readily influenced to form judgment from a restricted viewpoint as is the average superintendent.

Frequently it is advisable to place the chief inspector under the sales-manager, when the president or plant manager prefers not to direct this detail. If the sales manager is properly qualified as he should be, by practical knowledge of shop operations, the author believes he is fitted to supervise the inspection department. It is he who will be most handicapped in the future if the consumer receives unsatisfactory material.

Problems Encountered

The metallurgical department is listed under one of the chief company executives, for the reason that the importance of questions and practices related to the metallurgy of steel are such as to require all the judgment that can be exercised. If the plant manager, to whom appropriately the metallurgical department can report, feels incapable of settling a question personally, he always has recourse to the opinions of his practical shopmen. Having these to supplement the sound judgment supposedly characterizing a manager, questions relating to the chemical composition and the physical properties of the metal, and to the details of melting and heat-treatment practice, are most likely to be decided wisely. It is appropriate to state here that metallurgical problems are much more numerous and frequently more difficult of solution in the steel foundry than they are in the steel mill.

Sometimes it is found most satisfactory to put the order or schedule department jointly under the direction of the salesmanager and the plant manager. The sales department, which sometimes exclusively controls the preparation of foundry schedules, may be influenced too much by the pressure of insistent customers, even though they may have no justification for complaint from the standpoint of commitments. A subordinate in the sales organization who receives repeated and exasperating demands for better service than has been promised or can reasonably be expected, is likely to transmit the pressure to individuals in the shop, who may have to be guided by resulting instructions, regardless of their effect on general operations.

Generally it is most effective to have under the manager, a works en-

gineer to supervise construction and maintenance, to whom the master mechanic may report. This engineer should constantly give attention to power conservation. This includes looking for airleaks, providing, with the least amount of current, the proper amount of artificial light suitably located, the reasonably frequent cleaning of windows and skylights to reduce the required amount of artificial illumination, the systematic upkeep of buildings, and the intelligent direction of all repair work on equipment. For this purpose, the works engineer should have access to correct records showing the allocation of maintenance expense charged to individual items, all of which should be plainly identified with the shop.

Classify Departments

In designating the departments to be headed by the shop superintendent, certain selections ought to be governed by the personal qualifications of the superintendent. In most cases it has been sufficient and satisfactory to give this official jurisdiction over the following departments: Patternmaking, molding, coremaking, flask repairing, melting, pouring, shakingout, cleaning, heat-treating, and shipping. The innumerable details included in the execution of these duties keep an industrious and systematic man busily engaged. If the foundry is not of the smallest size, the superintendent should have several assistants. One such should have jurisdiction over molding, core-making and pattern-making. Another assistant may be delegated to follow intensively all work in cleaning, heat-treating and shipping. It may be practical to give this latter assistant certain other duties in keeping with his former experience and particular ability.

There should be a head molding foreman, the number of whose assistants is governed by the number of molders. The coreroom must have its foreman, and in many cases he needs a subordinate of the type ordinarily termed straw boss. Cleaning operations include torch-cutting, sprue-cutting, chipping, grinding, blasting, tumbling, and welding. Such work includes so many details of importance that one or more foremen may be required to supplement the activities of the assistant superintendent.

Some steel foundries produce sufficient tonnage to require considerable unskilled labor in many departments. For this purpose a floating gang sometimes is suitable. Such a group should be under the control of a general labor boss reporting to the shop superintendent, and in addition, taking instructions from his assistants and subdepartment heads. In a fairly large steel foundry, innumerable things are to be done requiring the cheapest class of labor, and a properly constituted labor gang invariably can be kept busy, conserving the time of better-paid workmen.

In shops where night work is necessary, it generally is best to have those in charge of the several crews on the night shift report to one man in general charge, who receives his instructions both from the shop superintendent and from the day subdepartment heads. In pointing out that melting should come under the shop superintendent, and that the heat-treatment ovens should come under one of his assistants, reservation is made regarding orders to govern manipulation, transmitted by those higher in the organization, for the execution of which the shop men mentioned should be responsible.

It is superfluous to outline many reasons for assigning certain shop responsibilities to designated individuals. The arrangements suggested for the work to be done by the line rather than the staff departments are not submitted with the idea that they will suit all conditions. The general scheme outlined has worked well in certain foundries of average size and character. However, there is a wide range of desirable modifications of any shop department plan because of enormous differences in nature and tonnage of plant output. Hence, there is more opportunity for fruitful discussion of suitable arrangement of staff divisions than there is of line departments.

Given Free Hand

A foundry such as the author has been considering is one that, so far as the company officials are concerned, is self-contained; that is, one operated as a single unit, and not one of several foundries in a consolidation.

Obviously where several plants are owned by one company, procedures must be adopted for a discriminating degree of authority given to local directing representatives. The author's experience indicates that the resident manager should be given reasonable freedom in prescribing how specified results may be obtained. He should have no restrictions placed on the selection of his subordinates. He should have a voice in decisions regarding any operating procedures laid down to be strictly observed. His judgment ought to be followed to a large extent as to policies governing relations with working men, because of his familiarity with local conditions. Sometimes a large corporation expects results from the resident manager without giving him proper latitude in following his own judgment. The man in charge of a plant detached from headquarters occasionally occupies an unpleasant position, the difficulties of which are inadequately appreciated by his superiors.

To Report on Sand

The report of the work of the foundry sand investigation committee will be of interest to all foundrymen attending the Syracuse meeting of the American Foundrymen's association which will be held the week of Oct. 5-9, for new developments will be discussed. Since the Milwaukee meeting, many of the largest foundries of the country have undertaken sand control testing and the benefits to be derived from such work will be discussed from a practical standpoint. Two new committees of the sand research committee will have preliminary reports to make. These reports will be those of the subcommittee on grading, and the subcommittee on core tests. The subcommittee on grading will discuss the possibility of establishing standard specifications for grading and buying sands. The need for such standards has been felt for a long time and the results the committee hopes to accomplish lead to the use of specifications in buying sands.

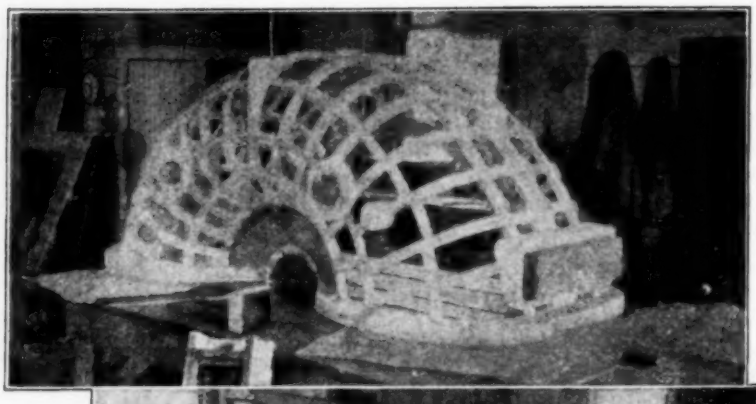
The subcommittee on core tests is investigating the possibility of establishing methods of testing the core sand mixtures, similar to tests developed for molding sands. The committee on foundry refractories is developing a discussion session where problems peculiar to each phase of the foundry practice will be given prominence. A pamphlet listing live refractory questions is to be distributed and solutions will be discussed at this meeting.

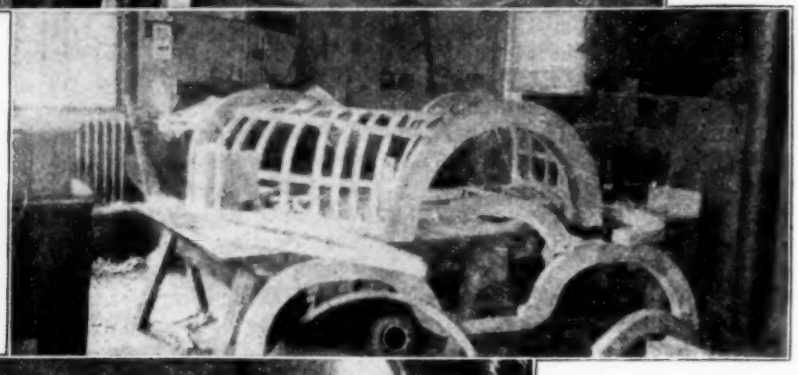
Gives Illustrated Talk

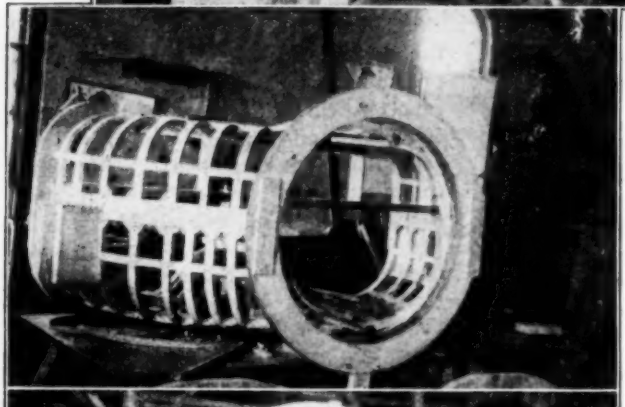
The Philadelphia Foundrymen's association held its monthly dinner meeting Tuesday evening May 12 at the Manufacturers' club. The meeting was addressed by William Kuebler, chief chemist, South Philadelphia works, the Westinghouse Electric & Mfg. Co. Mr. Kuebler augmented his interesting talk with over 100 lantern slides which materially aided him in describing the South Philadelphia plant at Essington.

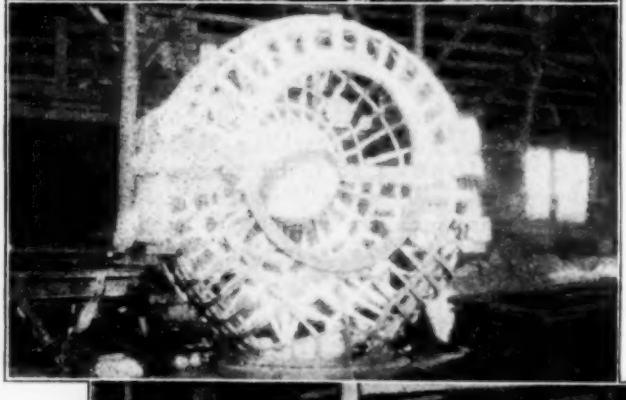
Adopt Skeleton For Turbine

Patternmaker and Molder Method Involving





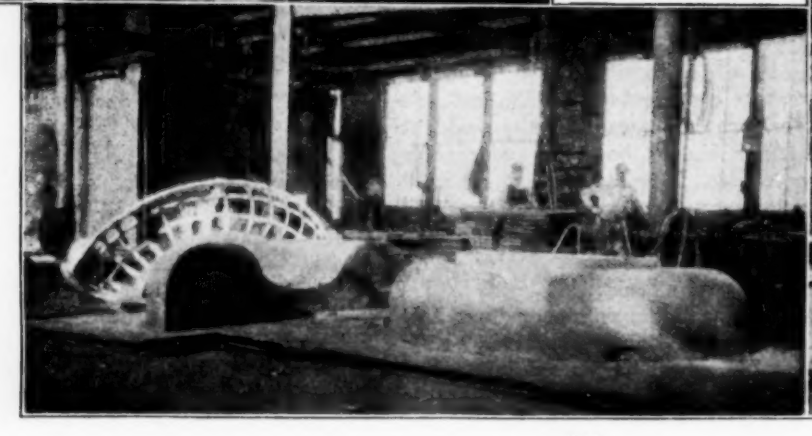


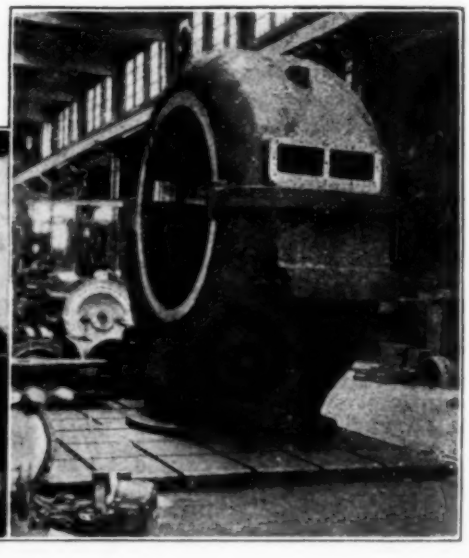


Figs. 1, 2, 3, and 4—Progress may be noted in the construction of the skeleton pattern. The manner in which the patterns were utilized as core-boxes is shown in Figs. 5, 6 and 7

FACILITIES for handling the mold in the foundry usually play an important part in deciding the manner in which a pattern shall be constructed for an odd or unusual casting. Another factor and one that usually receives serious consideration is the probability of the pattern being or not being used again. Several methods are available for making castings similar to those shown at the bottom of the page. The method shown in the various illustrations was adopted at the plant of the Jas. Howden & Co., Inc., Wellsville, N. Y., in producing a steam turbine exhaust end casing for a 2500 kilovolt-ampere direct connected generator condensing machine designed to operate under a 29-inch vacuum. The two halves of the casting assembled measured 7 feet 11 inches high, 7 feet 11 inches wide with a metal thickness of 1¼ inches in the body and 2⅝ inches in the flanges. The lower casting weighed 5100 pounds and the upper casting weighed 3443 pounds. The exhaust opening is 42 inches in diameter. The photographs as they are arranged illustrate the progress of the job in regular sequence from the pattern shop to the erecting floor in the machine shop.

Special rigging for making the mold was held to a minimum of two lift-





Pattern Plan Casting

Display Ingenuity in Minimum Expense

By Wilbur B. Kresge

ing plates for the drawbacks on the lower casting and one lifting plate for a similar purpose on the upper casting. The drawbacks obviated the necessity of providing a deep cope with the bars cut to suit the contour of the pattern. The entire pattern was bedded in the floor and was covered by a comparatively shallow cope.

The skeleton frames first were taken to the core room where they were placed on plates and used for coreboxes. Each half pattern was rammed full of sand which was reinforced with suitable rods and provided with hooks for handling the core after it was dried. A print 8 inches long was built on the round opening in the lower half pattern, but the core for the upper half was cut flush with the face of the flange.

With but slight variations both halves of the casting were molded in the same manner. A description of one will serve for both. The lower half of the pattern was adjusted in place in the pit with runner cores leading to the lower part of the flange. Sand then was rammed outside and inside the pattern until it was flush with the joint line. The upper half of the pattern then was set in place and rammed full of sand. The space at both ends between the pattern and the

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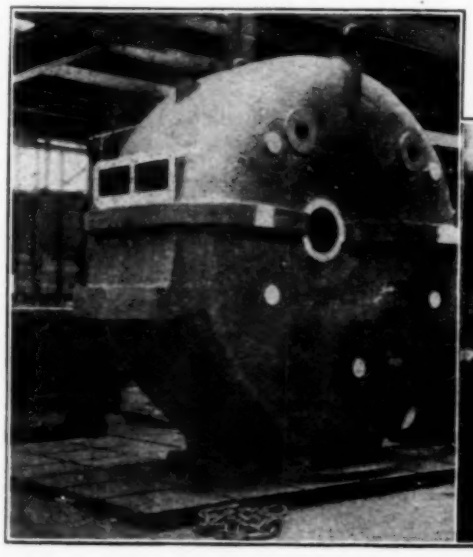
Fig. 8, 9 and 10—The mold is shown at three stages of the assembling process. Two views of the assembled casting on the floor of the erection shop are shown in Figs. 11 and 12



Pouring Temperatures Control the Quality of Brass Castings

Brass Shop Problems Discussed in Paper Presented Before Annual Meeting of American Foundrymen's Association — The Authors Are Connected with the Ohio Brass Co., Mansfield, O.

By F. L. Wolf and Wm. Romanoff

NO SINGLE operation in the foundry has more influence in determining the quality of the ultimate finished product than that of pouring at the proper temperature.

To obtain a better metal, it is necessary while melting, to see that the molten metal is properly protected from the air and that it is not permitted to *soak* in the furnace. The furnace must have the proper atmosphere, namely oxidizing, neutral or reducing. Open-flame, crucible or electric furnaces may be used to melt mixtures of scrap and virgin metal. The good results of all these precautions are offset if the metal is poured at an improper temperature. This statement may at first thought appear to be ambiguous, but upon further analysis or a trial will prove convincing.

In the foundry of the Ohio Brass Co., Mansfield, O., we manufacture valves, line material for electric railways, mining material, etc. To show the effect of pouring at the wrong temperature, consider the case of pouring one of our alloys. In this particular case we used 50 per cent virgin metal and 50 per cent gates and sprues from our own foundry. A difference of 100 degrees Fahr. between the proper temperature, which we will designate *A* and the improper temperature, which we will designate *B* gave us the following difference in physical properties:

Temperature	Tensile strength in pounds per square inch	Per cent elongation in 2 inches	Per cent reduction of area
A	27,550	14.6	15.3
B	16,316	7.5	6.4

The same furnace conditions were maintained in each case. *A* and *B* were poured from the same pot of metal.

Test bars and castings were poured at temperature *B* and the remaining metal chilled with gates and sprues to temperature *A* and poured. We hear of salesmen selling a cheaper grade of brass products accentuating the fact that their material is as good as their competitors because it has the same composition. It could be likened to comparing two different makes of automobiles because their bodies happened to have the same color, workmanship to the contrary.

The results as recorded are consistent with theory and with those that we have always obtained in practice in our foundry since the introduction of temperature control. Molten metal has a tendency to absorb gases, the higher the temperature, the more gases absorbed. Upon cooling these gases are given off. When pouring a casting, the outer surface solidifies first. The higher the pouring temperature the more gases entrapped between the crystals of the metal and the less dense and more brittle it will be.

When castings leave the foundry, they are sent back to the brass casting department where the gates are cut off. The castings are rough ground and sandblasted. They then are inspected and divided into the following groups: Misrun, dirty, shifted and good castings.

Shifted castings are due to faulty molding or pattern equipment and will be eliminated from this discussion. We find that the percentage of dirty castings is greatly increased when they are poured at too high a temperature. This is accounted for as follows: If the metal is excessively hot, the temperature is such that it retains the oxides and other impurities in a fluid or plastic condition. When pouring the metal in such condition, the surface of the metal in contact with the mold solidifies, thereby entrapping oxides and impurities and causing *dirty* castings. If the metal is chilled to proper pouring temperature the oxides and other impurities are permitted to solidify and due to their lower specific gravity float to the surface. The slag then may be skimmed off. If the metal is too hot, it also has a tendency to *eat* into the sand, causing rough, dirty castings. On the other hand pouring the metal too cold, is likely to cause *misruns*.

To give a further illustration of the effect of pouring at too high a temperature, we will cite the case of pouring another one of our alloys. A mixture of 50 per cent scrap and 50 per cent virgin metal was used. As in the previous alloy, there was only a difference of 100 degrees Fahr. between the higher or improper pouring temperature *B* and the proper pouring temperature *A*, with the following difference in physical properties:

Temperature	Tensile strength in pounds per square inch	Per cent elongation in 2 inches	Per cent reduction of area
A	25,800	27.6	32.9
B	25,475	14.7	18.7

The entire question of pouring temperatures may be summarized into the statement that when metal is overheated or permitted to *soak* in the furnace for too long a time, gasification of the metal takes place, instead of an oxidation which generally is supposed to be the case. That probably accounts for the fact that upon chilling an overheated metal, it practically returns to its normal state. The pouring temperature should be as low a possible, consistent with the size and shape of the castings to obtain the best possible physical properties.

There is always a question as to the quality of metal produced by different types of furnaces. In our brass foundry we operate three types of furnaces, the open flame type as represented by Schwarz furnaces, the crucible type as represented by Steel-Harvey furnaces and the electric as represented by an indirect arc type furnace. As the management insists that everything be subservient to quality in the manufacture of our products, we have experimented extensively to determine whether one or more of these types of furnaces should be eliminated from our foundry due to producing an inferior grade of metal. At the present time we have installed an electric furnace of the induction type, as yet, we have not enough data to allow this to enter into a comparison with the other types of furnaces.

Costs from the standard upon which the majority of companies base their

conclusions as to whether any equipment or process is to enter into production. It is especially prevalent among the smaller companies. As this is not a discussion of business economics we will get to the point in question. At our plant the cost of melting one ton of metal in electric, Schwarz and Steel-Harvey furnaces is as follows: Electric, $22.99; Schwarz, $20.38; Steel-Harvey, $17.86. Power for electric furnace has been figured at the rate of 2 cents per kilowatt hour. Fuel oil for Schwarz and Steel-Harvey furnaces at 6 cents per gallon. This comparison includes fuel, labor, lining, melting losses, crucibles and all other incidental items necessary to melting metal, and was compiled during a long period of time. In addition, the slag recovery is also included as we operate a concentration plant. Space does not permit us to itemize the individual costs.

Utilizing Scrap Materials

Every foundry that operates a machine shop has a continuous influx of brass borings and turnings to be remelted. In addition there are the gates and sprues which have been cut off from the castings. As near as possible all of this scrap material should be used in the foundry in the same proportion as it is received, thus avoiding any unnecessary accumulation. This greatly reduces the cost of the raw material as compared to what it would be if only virgin metal were used in the manufacture of castings. We had to do considerable experimental work to determine whether this scrap would be detrimental to the metal, and if not, in which proportions it could be added safely. In carrying out these experiments, all melting and pouring conditions were maintained as uniformly as possible. The only variations being in the combinations of scrap and prime metal used.

In the manufacture of one of our bronze alloys we used three combinations of metals, one consisting of all prime metal, one of equal parts prime metal and scrap, consisting of gates and sprues, and one containing all scrap, consisting of gates and sprues. Table I gives the proportion of scrap used, and the physical properties obtained.

While the ultimate tensile strength is slightly reduced, when using half scrap and half prime metal, there is no radical difference. The elongation, reduction of area and brinell hardness are practically the same using any of the combinations.

In another case, we used combinations of prime metal, scrap, such as gates and sprues, and composition ingot metal purchased from various smelting and refining companies. These were used in making one of our brass alloys. Composition ingot usually is obtained by refining concentrates, borings, turnings, etc. Fig. 2 shows the physical results recorded.

It will be noted that there is a slight variation in the reduction of area, but the remainder of the results are fairly consistent.

We melted another one of our brass alloys using 25 per cent of borings in one case, the remainder being ingot, scrap and prime metal and in another case we eliminated the borings. Following are the results obtained:

Mix	Ultimate tensile strength in pounds per square inch	Per cent elongation in 2 inches	Per cent reduction of area
With borings	27,655	14.7	14.0
Without borings	28,825	16.9	17.6

These results are again consistent. In the combinations of scrap and prime metal used, one thing must be taken into consideration, and that is that when all other conditions are equal, a greater shrinkage takes place in the castings in proportion to the amount of prime metal used in the mix. Several theories have been offered to account for this. We offer no explanation, although we know that it is a fact.

The sum and substance of the whole subject of mixes may be simmered down to the following: Any reasonable combinations of prime metal and scrap may be used providing there are not too many detrimental impurities present such as antimony, iron, etc., and that proper foundry conditions have been maintained. In our foundry we have been obtaining consistently good results by using any number of combinations.

In melting brass or bronze alloys, the red metal is melted first and when molten, we add the white metal. About 5 to 10 minutes later, we pour. In the interim between adding the the white metal and pouring, we add a little sand as a covering to prevent as much as possible the volatilization of zinc while the metal is in the molten condition.

Explain Use Of Deoxidizers

We have always obtained good results by the use of deoxidizers, but like most good things an excess may often prove deleterious. The choice of the specific deoxidizer depends a good deal upon the individual user in which psychology plays an important part. We have found phosphor copper containing about 8 to 10 per cent phosphorus to be the most practical in our foundry. We add a fraction of an ounce per pot of metal, containing 100 to 150 pounds. It is added just before pouring. If an excess of phosphor copper is used it has a tendency to *cut* the sand in the molds causing rough, dirty castings; which are deteriorated due to the formation of the hard brittle Cu, P compounds. In the high lead alloys, the lead segregafed to the outer edge of the castings ruining the appearance, and causing porous metal.

Aluminum as a deoxidizer should never be used in an alloy containing lead. Porousness is almost certain to occur and such an alloy could not be used to withstand any internal air pressures.

(*Concluded on Page* 450)

Table I

Prime Metal and Scrap Used

MIX Per cent prime	MIX Per cent scrap	Ultimate tensile strength in pounds square inch	Per cent elongation in 2 inches	Per cent reduction of area	Brinnell hardness
100	0	37,050	23.4	21.2	72
50	50	34,500	21.1	21.0	68
0	100	38,566	22.9	21.1	68

Table II

Prime Metal Composition Ingot and Scrap Used

MIX Per cent ingot	MIX Per cent scrap	Per cent prime	Ultimate tensile strength in pounds per square inch	Per cent elongation in 2 inches	Per cent reduction of area	Brinell hardness
0	33	67	24,450	14.3	13.0	52
25	27	48	23,841	13.2	9.4	54
50	33	17	23,266	12.2	10.1	50
75	0	25	26,800	16.1	15.2	48

How and Why in Brass Founding

By Charles Vickers

Bronze To Resist Acid

We are called upon to make bronze castings suitable for acid resisting purposes. The acid is 2 to 5 per cent hydrochloric, and the castings are for pumps. Will you oblige us with a suitable formula?

The most important thing in making bronze to resist acids is to get it homogeneous in structure. None of the common alloys, and by common is meant alloys of copper with tin, zinc, lead, aluminum, either binary, ternary or consisting of all the metals mentioned, are of value in resisting acid solutions. They will be attacked and hydrochloric acid is particularly destructive with copper alloys. A good alloy to use for these pump castings is as follows:

ACID RESISTING ALLOY

	Per cent
Copper	89.50
Tin	10.00
Manganese copper	0.50

The manganese copper should be iron free, and must contain 30 per cent manganese. Pour this alloy on the hot side. This bronze will resist the action of a 5 per cent acid solution. With 10 per cent hydrochloric acid solution it would be easily attacked. A fracture test from this alloy should show a dense and uniform grain. No *burning in* or patching of the castings must be resorted to because the acid will attack such weak parts.

Discuss Molding Sand for Aluminum Castings

In the near future it will be necessary for us to produce aluminum castings having a surface similar to die castings. We plan to use French sand and keep our metal mixture as near as possible to that of the No. 12 aluminum alloy. Can you advise us how to do this?

We are rather dubious as to the suitability of French sand for making molds for casting aluminum alloys. This sand is used more particularly for statuary castings. A sand such as *Windsor Locks* would be much better for the purpose outlined than statuary sand, provided it is to be used as a facing. The mold should be made of the ordinary heap sand, and then be *printed back* after the *Windsor Locks* has been dusted over the impression through a bag.

If the regular sand piles are to be changed for a sand of finer grade, the best move to make will be to consult with the molding sand specialists whose advertisements will be found in THE FOUNDRY. You require a sand of fine grade, but open grained for aluminum work.

In regard to the aluminum alloy, the No. 12 consists of 92 per cent aluminum and 8 per cent copper, and it should not be difficult to adhere to this formula.

How To Solder Aluminum

Will you give us a method of soldering aluminum. We find it necessary at times to solder defective castings of aluminum alloy, but although we have experimented with several brands of aluminum solder we cannot say that we have been successful.

Perhaps the solder is not at fault, but the method of using it. The manufacturer should give definite instructions on using the solder, and perhaps this has been lacking. If one tries to solder brass without a flux, the result is a failure owing to the brass being covered with a thin film of oxide, to which the solder will not adhere. The film must be removed and the clean metal exposed, this being the province of the flux. In the case of brass there is a time interval between the removal of the film and the growth of a new one, and during this interval, the solder may be applied and will stick. In the case of aluminum a film also exists on the surface to be joined, and no flux has yet been discovered that will remove it. If the flux is removed, a new film forms instantly, there being no appreciable time interval, between removal and growth.

To solder aluminum the covering film must be removed, as chemicals will not do it, mechanical means must be resorted to. First the aluminum must be heated until the solder melts and fills the cavity. The insulating film on the aluminum must be scrubbed off, while the surface is covered with molten solder, so the latter may contact with the bare, clean metal. A few trials will show how to do such soldering in a successful way.

Brass Water Meters Cause Trouble

We wish to make a number of brass water meters. We desire to use the best alloy possible to overcome water corrosion. For the bodies and chambers we have specified a mixture of copper 87 pounds; tin 7½ pounds; zinc 3½ pounds, and lead 2 pounds. For the pinions and gears we use copper 90 pounds; tin 10 pounds. Can you suggest better mixtures?

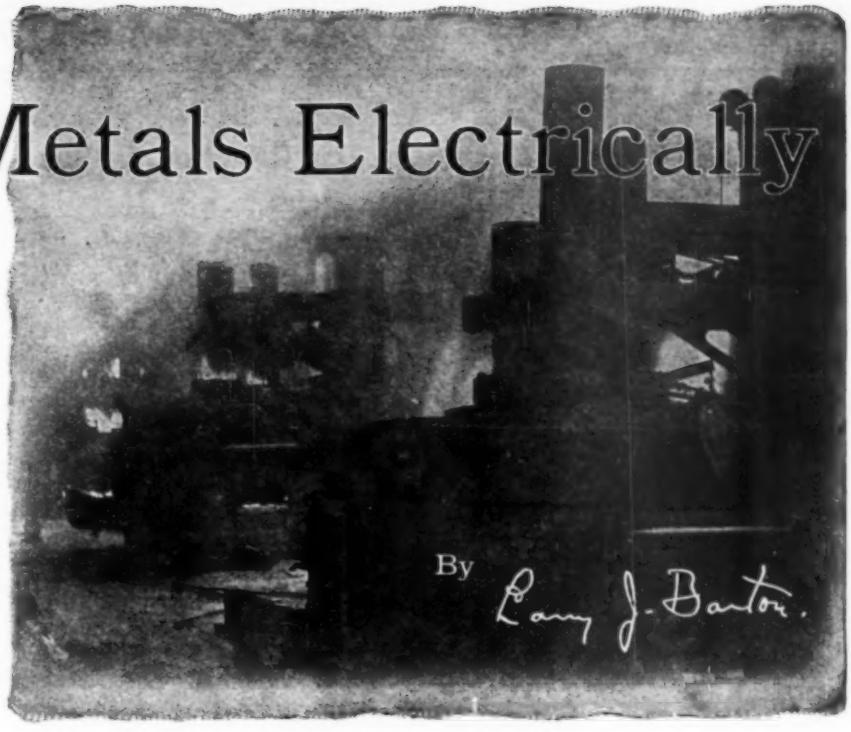
The alloys mentioned are what would be termed high grade metals. The mixture of copper 90 per cent and tin 10 per cent usually is regarded as an acid resisting alloy, but it may be improved for such purposes by the substitution of 0.5 per cent of manganese copper containing 30 per cent of manganese. An alloy extensively used for gears and pinions is copper 86.5 per cent; tin 6.5 per cent; zinc 3.5 per cent, and lead 3.5 per cent. We have no means of knowing whether it would work any better in connection with your local waters than the 90-10 alloy. For the bodies and chambers it would be well to test a red brass with a high zinc content and we suggest the following formula: Copper 79 per cent; zinc 12 per cent; lead 7 per cent, and tin 2 per cent. Water meter bodies and chambers have been cast of this alloy by the hundreds of thousands in America and shipped to all parts of the world, where they have given satisfaction, during the past 30 years or so.

Use More Core Oil

We have occasion to make numbers of lead castings containing five per cent antimony and have difficulty getting out the cores, as the metal eats into the sand and fills the cavity with a mass of metal and sand. We use an oil sand core mixed one part oil to eighty sand.

Cores mixed one to eighty are too soft and if they are made harder by increasing the oil content and while damp are sprayed with a mixture of plumbago and molasses water, then after drying are painted over with the same mixture of plumbago, but mixed to a creamlike consistency and redried, they will be made impervious to the lead.

Refining Metals Electrically



Chapter VI (Continued)

Duplexing Gray Iron Gives High Quality Metal—Handling Slags

THE basic process offers the great advantages for melting gray iron, in that superheating is possible, and there is the added advantage of great refining, coupled with close chemical control. It is toward this method of operation that future developments are tending along wider lines.

By using the cupola to melt the charges a large saving is made in the cost of conversion, as practically 80 per cent of the power used is for melting. The advantages of the electric furnace, except in special cases, is manifested only during the finishing operation, after the heat has reached the molten state. Any means to cheapen or hasten the melting of cold scrap is of prime importance and deserves serious consideration.

The metal as melted in the cupola does not require much pig, only enough being used to insure proper melting, and in many cases a charge of 100 per cent scrap may be used. This molten metal is transferred to the electric furnace by an ordinary foundry ladle, and as soon as it is placed in the furnace, the current is turned on, the lime slag added, and the metal superheated and refined to the desired point. While this treatment greatly improves the iron it involves a certain cost. Consequently, the best success is obtained when the cupola itself is operated along lines of the highest possible efficiency. Iron which has been badly burned in the cupola, or iron from a poor grade of scrap, never can be brought back into a first class metal, except at an unreasonable cost in time and current for electric refining. In the same manner, the hotter the iron comes from the cupola the less time required in the electric furnace to superheat. Hot cupola metal means a considerable power saving.

The time which will be required for a heat of iron to be duplexed in the electric furnace will depend upon certain points. These are:

The sulphur in the initial charge.
The sulphur allowable in the final product.
The initial temperature of the iron entering the electric furnace.
The required pouring temperature.
The condition of the metal in relation to its amount of oxides or other gases which must be eliminated.
The amount of chemical manipulation which may be required.

Under a lime and fluorspar slag, consisting of approximately 2 per cent of the charge in weight, it will take about 30 minutes under a white falling slag to lower the sulphur 0.05 per cent. The same length of time will raise the temperature of the iron poured into the electric furnace about 275 to 300 degrees Fahr. As conditions change, this period may be prolonged to an hour, or even more in special instances. For the shop entering on electric duplexed iron, 45 minutes will prove to be suitable at the start, until exact figures are obtained, when the time may be either lowered or increased.

George K. Elliott, Lunkenheimer Co., Cincinnati, gives the following figures on the elimination of sulphur during duplexing:

Per cent sulphur	Time in electric furnace minutes
0.156	As received from the cupola
0.133	10
0.112	20
0.079	30
0.036	40
0.031	50
0.014	64

From these data it may be seen that this particular heat could have been nicely poured at the end of the 35-minute period, the melting in this instance being prolonged in order that further data on the sulphur reduction could be obtained. The refining action of slag on a heat of cast iron is extremely powerful, due to the fact that the lime may be literally soaked with coke dust or other carbonaceous matter, without any detriment to the metal, a point of impossibility when working a heat of steel. As the elimination of sulphur follows directly the rise in temperature, a high temperature coupled with a heavy carbide slag is a strong indication of the degree of desulphurization. Of course, exact figures of time must be worked out accurately for each shop, as different localities will have scrap, varying in its condition

Does Electric Furnace Iron Pay?

TO MELT iron in the electric furnace costs more than to put it through the old reliable cupola. The fact is not disputed by any of the proponents of the former method. However, the closer chemical control, the elimination of elements that injuriously affect quality and the higher pouring temperatures attainable make the electric melting process attractive to many castings manufacturers. In this section of his chapter on electric furnace iron, Mr. Barton recommends the basic process and favors duplexing, that is melting first in the cupola and then refining in the electric furnace. Details of control are offered and the proper methods of handling the slag are given in full.

Table LII

Chemical Changes in Acid Cast Iron

	Percentages of				
	Tot. Car.	Mang.	Sil.	Phos.	Sul.
Borings 100 Per cent Charge	3.44	0.63	2.12	0.244	0.077
	3.39	0.63	2.16	.....	.....
Heat analysis	3.39	0.66	2.13	0.248	0.077
	3.41	0.66	2.17	.....	.....
Pig iron 100 Per cent Charge	3.47	0.45	3.28	0.112	0.047
Heat analysis	3.56*	0.46	3.14	0.114	0.058
Charge	3.45	0.55	3.27	0.039	0.014
Heat analysis	3.42	.....	3.24	0.022	0.023
Charge	3.75	0.54	3.26	0.042	0.010
Heat analysis	3.69	0.55	3.12	0.042	0.024

and also in its chemical analysis.

Assuming that the electric furnace has just finished pouring a heat of either iron or steel, the first step will be the patching of the hearth and walls, and the time allowed for this fettled material to set slightly. The furnace now is ready for the ladle of metal from the cupola. Several permissible methods of adding the slag making material may be followed. It may be added on the hearth before the ladle is brought up; it may be added to the furnace as the metal is being added; or it may be added after the furnace has been filled.

Of these three the second method probably is the best. If the slag making material is added to the hearth, there is always a tendency for the lime to cake and build up the bottom, requiring added labor to keep the hearth in its proper shape and depth. If the slag making material is added to the iron after the furnace has been filled, there is again the tendency to cake until the iron has become thoroughly superheated, thus lessening the effective time in which this slag has to operate on the metal. By adding the slag material to the incoming stream it is at once heated throughout; it is thoroughly distributed not only on the surface of the metal, but throughout the mass of the iron itself. Therefore, there is little chance of this slag caking, and the effective time of refining is lengthened.

This slag will be made of the required amount of lime thoroughly mixed with crushed fluor spar and coke dust. The spar will consist of about 20 to 40 per cent of the lime, while the coke will be the amount required to give the slag mixture a dark color. This slag either may be shoveled into the furnace or placed in a chute over the door so that by opening a door the contents will flow into the stream, in a manner similar to certain open hearth installations where such a contrivance is used to add the ferroalloy to the ladle. The main points of importance relative to the slag are that it should be of a small mesh size, and that it should be thoroughly mixed. The easiest method of obtaining such conditions is to mix a large batch at one time in a grinding pan, where the components are not only thoroughly mixed, but pulverized during the operation. While the data on slags are followed by the writer, changes may be required in various localities, due to changes in the scrap available, the character of the lime and spar, etc.

The metal and slag being in the furnace the entire bath is given a heavy dusting of coke and the furnace sealed. If working under strict chemical specification this is the proper time to take a test for chemical examination. Otherwise the furnace doors are tightly closed and the current started. It will take approximately 10 minutes under a full load to eliminate the chilling effect which the metal has experienced during transportation from the cupola, unless the iron has been tapped at a high temperature. At the end of this 10 minutes, the door should be opened

Table LIII

Physical Tests of Acid Iron**

	Tot. C	Mang.	Sil.	Phos.	Sul.	Load	Mod. of Rup.	Deflection
Borings	3.21	0.50	2.46	0.58	0.098	3460	54000	0.154
	3.18	0.46	2.11	0.72	0.090	3220	50200	0.171
	3.26	0.57	2.29	0.51	0.088	3330	52000	0.183
Pig and scrap	3.25	0.74	2.18	0.10	0.025	3280	51200	0.175
	3.26	0.57	2.21	0.24	0.030	3370	52600	0.212
	3.28	0.76	2.20	0.24	0.044	3300	51500	0.157
Shop scrap	3.28	0.50	2.23	0.51	0.082	3610	56300	0.159
	3.30	0.50	2.15	0.52	0.087	3370	52500	0.195
	3.23	0.47	2.32	0.48	0.086	3420	53400	0.175

**H. M. Williams and T. B. Terry, Trans. Am. Elec. Chem. Soc., May, 1922.

Table LIV

Acid Electric Furnace Iron*

	Tot. C	Mang.	Sil.	Phos.	Sul.	Cr.	Ni.	Load	Mod. of Rupt.	Defl.
Pig, Iron, shop scrap and 20 per cent steel.										
	3.24	0.60	2.13	0.58	0.065	....	....	4440	69250	0.185
	2.97	0.57	2.10	0.54	0.069	....	....	4680	73000	0.175
	3.23	0.76	2.47	0.69	0.025	....	....	4250	66300	0.222
	3.16	0.70	2.45	0.155	0.024	....	....	4350	67900	0.200
	3.01	0.50	2.00	0.138	0.026	....	....	4680	73100	0.183
Pig Iron, 20 per cent steel, 10 to 12 per cent Mayari Iron.										
	3.07	0.70	2.62	0.22	0.037	0.40	0.20	4480	69800	0.169
	3.11	0.58	2.69	0.248	0.038	0.36	0.18	4520	70500	0.172
	3.02	0.65	2.72	0.12	0.030	0.25	0.12	4570	71400	0.175
	3.31	0.68	2.28	0.120	0.025	0.30	0.15	4460	69500	0.230
	3.03	0.56	2.58	0.085	0.023	0.28	0.14	4640	72300	0.241

*H. M. Williams and T. B. Terry.

Table LVI

Improvement of Cast Iron Due to Duplexing*

	Carbon	Silicon	Manganese	Phos.	Sulphur	Transverse Strength
Cupola	3.48	1.92	0.56	0.53	0.099	2812
Electric	3.38	1.82	0.61	0.51	0.022	4118
Cupola	3.50	1.79	0.54	0.62	0.158	2770
Electric	3.22(1)	1.94(2)	0.54	0.61	0.052	3985
Cupola	3.35	1.91	0.72	0.59	0.091	3748
Electric	3.26	1.77	0.73	0.58	0.018	5096
Cupola	3.40	1.94	0.42	0.58	0.069	3602
Electric	3.41	2.21(2)	0.44	0.56	0.026	4212
Cupola	2.90	1.54	0.43	0.54	0.151	....
Electric	2.91	2.28(2)	0.51(3)	0.55	0.013	4200
Cupola	2.77	0.89	0.24	0.44	0.160	....
Electric	2.69	2.18(2)	0.52(3)	0.40	0.057	5114
Cupola	3.39	2.16	0.77	0.62	0.057	2815
Electric	3.14(4)	1.90	0.84	0.55(4)	0.019	3824
Cupola	3.45	1.83	0.34	0.48	0.112	3316
Electric	3.38	2.30(2)	0.36	0.47	0.033	4022
Electric only	2.94	1.52	0.62	0.27	0.009	4144

(1) Carbon reduced by mill scale in electric furnace.
(2) Ferrosilicon added in electric furnace.
(3) Ferromanganese added in electric furnace.
(4) Carbon and phosphorus reduced by dilution with steel.
*G. K. Elliot

Table LV

Log of Acid Electric Furnace Iron

SOFT MACHINEABLE IRON

The specification called for soft iron capable of being machined at high speeds and to take a high polish. The iron made analyzed: Total carbon, 3.64 per cent; silicon, 2.48 per cent; manganese, 0.57 per cent; phosphorus, 0.48 per cent; sulphur, 0.075 per cent.

The charge consisted of cast iron borings, 4500 pounds; shop returns, 5000 pounds; outside scrap, 2500 pounds; ferrosilicon, 120 pounds; ferromanganese, 36 pounds; gas coke, 120 pounds.

The time for the heat was 2 hours, 45 minutes. A 6-ton heroult furnace was used and the current used was 510 Kilowatt-hours per ton, using a hot furnace immediately following a heat of steel.

8:10 a. m.
Current on. Pulling good load from the start.

9:10
Charge rapidly melting. Added 50 pounds pea size anthracite coal.

10:00
Practically all molten. Test taken in sand mold.

10:15
Metal heating, but still sculling the spoon. Previous test broken. Metal shows a soft fracture. Six large scoops of sand mixed with 3 of burned lime added.

10:25
Slag well rabbled. Metal getting hot. Fracture thoroughly solid in chill mold.

10:35
Slag thoroughly mixed, very glassy and of a whitish grey color. Slag test poured in chill mold shows solid fracture with no evidence of shot or gas pockets.

10:45
Ferrosilicon and ferromanganese added. The slag given a dusting of coke.

10:50
Metal extremely hot. All appearances good.

10:55
Heat tapped. Castings poured perfectly the metal being extremely hot and easily pouring the most intricate pieces. Heat was poured on the floor for 45 minutes, the ladles draining perfectly clean. No pigged metal.

HARD IRON

The specification called for hard grey, no machining, but must be capable of being drilled, to be used for retorts for sugar refining work. The iron made analyzed: Total carbon, 3.05 per cent; silicon, 2.26 per cent; manganese, 0.27 per cent; phosphorus, 0.31 per cent; sulphur, 0.061 per cent.

The charge consisted of steel borings, 3000 pounds; shop returns, 3000 pounds; ferrosilicon, 135 pounds; and low ash coke, 210 pounds.

The time for heat was 1 hour, 10 minutes with 490 kilowatt hours per ton current consumption.

2:00
Current on. The coke was added with the charge as was the ferrosilicon.

2:45
Charge completely melted. Metal test taken and poured into chill mold to estimate carbon. Another test poured in sand mold for softness. Four scoops of sand mixed with lime added. Furnace given a light dusting of coke dust.

3:00
Previous softness test shows satisfactory. Chill test had previously been estimated at over 3 per cent. Slag fairly good, but rather lumpy. Given a good rabbling, and 20 pounds fluor spar added.

3:05
Slag a light yellow, and glassy. Good covering on metal.

3:10
Heat poured. Metal extremely hot. Sample bar poured on heat machined medium; drilled readily. Fracture of gates rather close grained, and considerably tougher than the average gate poured from the cupola.

and the slag examined. If of a satisfactory carbide character, a metal test may be taken for temperature and fracture appearance. If the slag has lumped, which is often the case, it must be rabbled thoroughly to break up the cakes, and may even require more spar. If too thin, more lime should be added. As slags on iron are under a lower temperature than on steel, this caking effect is more pronounced and it may require considerable experimenting until all additions are in proper condition. If the slag cakes, the only method of breaking it is by rabbling, and by the addition of either spar or sand. Sand should not be used, unless it is shown that the amount of spar being added is detrimental to the hearth and walls, as any undue percentage of silica in the slag will be reduced under such powerful carbide conditions, often resulting in a wide variance of the silicon content of the finished metal.

As soon as the slag is of the proper consistency, a test should be taken to determine the degree of reduction which is present in the furnace. This is made by taking a sample of the slag, pouring part on an iron plate, and cooling the remainder in water. If the slag is correctly proportioned, that poured on the plate will begin to crumble and fall apart as soon as the test becomes black. The surface of this slag either will be black or chocolate brown, the interior powder being dark gray. The slag will act as if worms were inside it, the best illustration being the way the ground appears when a gopher is coming to the surface. The test cooled in the water will be grayish slush giving off a heavy odor of acetylene. While this is the customary appearance, the writer has observed cases where the slag was hard and tough, of a reddish brown appearance yet contained nearly 10 per cent of calcium carbide. Such a slag is of rare occurrence, yet is far more powerful in its reducing action than the ordinary carbide, powdering slags.

Conditions are now right and the metal should be held in this manner only long enough to insure the lowering of the sulphur to the required point. Superheating will be coincident with this desulphurization, and as this latter generally takes longer, unless on iron intended for large sized castings, is generally used as the furnace indication. Metal tests are tak-

(*Concluded on Page* 464)

Table LVII

Heat Log of a Heat of Duplexed Gray Iron

The metal from cupola analyzed: Total carbon, 3.41 per cent; silicon, 1.37 per cent; manganese, 0.49 per cent; phosphorus, 0.62 per cent; sulphur, 0.129 per cent.

The charge in the cupola consisted of 20 per cent steel scrap, 40 per cent shop return and 40 per cent cast scrap. The metal from electric furnace analyzed: Total carbon, 3.29 per cent; silicon, 2.34 per cent; manganese, 0.44 per cent; phosphorus, 0.63 per cent; sulphur, 0.027 per cent. The time for heat was 2 hours 10 minutes with 267 kilowatt hour per ton current consumption; 18,095 pounds of metal was poured from electric furnace.

10:00 a. m.
Furnace started on approximately 10,000 pounds of metal from cupola. As the iron was poured into the furnace, 400 pounds of the following slag mixture was added: Lime 60 per cent, fluor spar 20 per cent, and crushed coke 20 per cent. Given a heavy covering of crushed petroleum coke, and the doors sealed. Power on at heaviest load.

10:50
Furnace given a kicker of about 8000 pounds of cupola iron. Doors again sealed.

11:10
Slag thoroughly rabbled and 50 pounds of spar added. Metal test taken and sent to chemist. At this point the metal is medium in temperature, the first ladle of cupola iron having been rather cold.

11:20
The slag has been a heavy carbide one right from the start, but at this point it has gone over into a perfect molten, and fairly thin condition. It shows excellent reduction. The metal pours nicely, with a distinct dip in the mold.

11:30
Ferroalloys added and well rabbled into the metal.

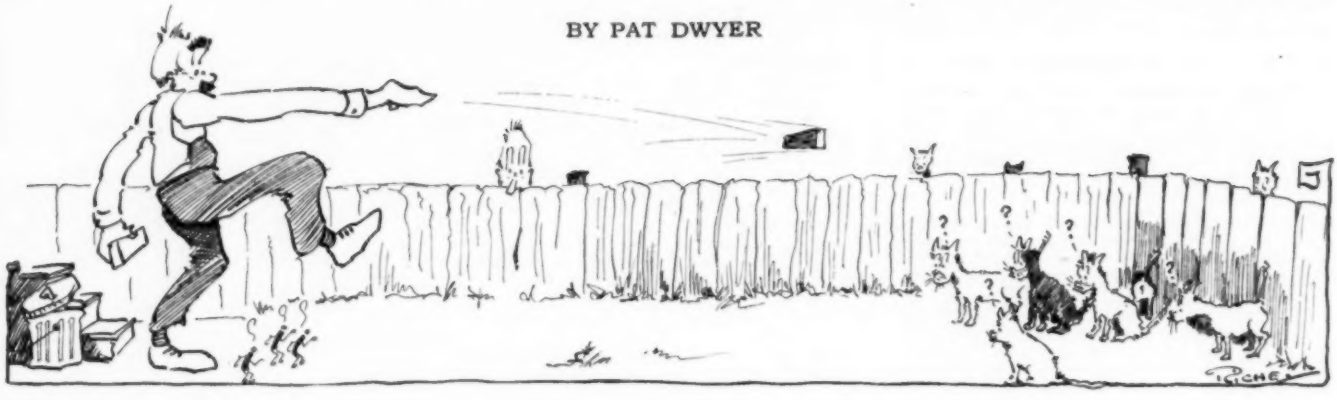
11:40
Test taken shows good diffusion of the silicon. The metal is hot, and the slag perfect.

12:00
Metal ready to pour, but held up 10 minutes waiting for the ladle.

12:10
Furnace tapped. Metal was poured from large crane ladle into smaller ones for pouring, considerable shanking being done. No skulls at finsh. All machined work.

Bill Learns How To Make a Pump Plunger

BY PAT DWYER



SEVERAL times during the past week I called up his house only to learn that Bill had not yet returned from an extended trip out of town. When finally I learned that he had arrived home Sunday morning I allowed the proper interval of time to elapse and did not call upon him until the shades of eve, and all that jolly old kind of poetical rot, were sinking o'er the lea. The only excuse I can offer for the referenne is that I was influenced by a beautiful early summer night, or perhaps a more accurate statement would be to say that it was an ideal night in late Spring. The trees were all in bloom, the breeze sighed sweetly and gently and the new moon hung low in the west, shy and retiring but fortunately seen first over my left shoulder.

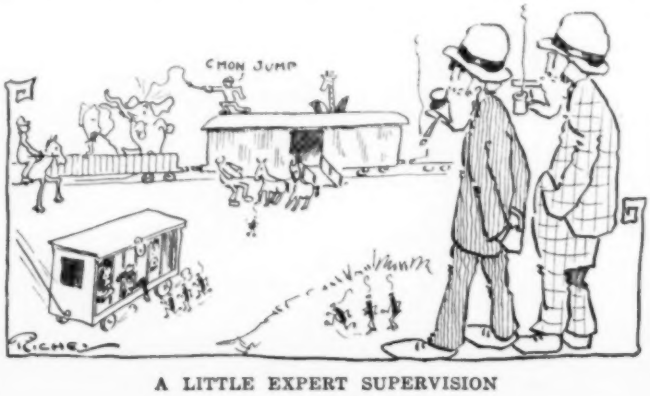
I am not superstitious and pay no attention to any of the tokens of ill omen that have come down through the centuries and that form part of the tacit belief of the entire Aryan race. Friday is the same as any other day to me so far as going on a journey is concerned. I have no qualms of concience in turning back for an article I have forgotten in the house. This may be due partly to the fact that I have forgotten so many things that the practice of turning back almost has developed into a regular habit. Holding up an opened unbrella in the house means nothing in my young life. The spectacle of a black cat, or even a flock of black cats, crossing my path arouses no alarm in my mind. To be strictly truthful I may as well confess that whenever I see a cat of any kind prowling around promiscously, I feel a strong inward urge to test the co-ordination of eye and throwing arm in landing a fair sized pebble in the general vicinity of its ribs. In my younger days I lived in a small town where throwing material was available almost everywhere and the rising generation had a fair opportunity to develop skill and technique in this and allied branches of sport. In later years, my lot has been cast in a city with paved streets and closely trimmed lawns where pebbles are as plentiful as honest politicians. Cats in the good old days had nine lives and needed them all. Under present conditions one is ample. In life insurance phraseology, the expectancy of the average cat is ace high.

When I inadvertently spill salt on the table, I do not immediately throw a pinch over my shoulder. I cover it up with the nearest available piece of table equipment and fervently hope that the lady who sits at the opposite end of the table has not noted my awkwardness. Sometimes I win, but up to present my score card is decidedly below par.

I have not the slightest belief in the magic virtues associated with horseshoes, pins lying fore or aft, wish bones, sprigs of mistletoe, hind feet of graveyard rabbits or lucky pocket pieces. Claims set forth by fortune tellers, soothsayers, gypsies, spiritualists and all that ilk are viewed with absolute indifference, slightly tinged with amused toleration. These people probably consider they have a right to life, liberty and the pursit of happiness and if a gullible public sees fit to support them, that is the public's privilege.

For a long time I clung faithfully to the belief that an itching palm meant meeting a friend or receiving money, depending on whether the tickling sensation manifested itself in the right or left hand. I kept a close check on the symptoms, but gradually through a series of consistent disappointments I developed into a rank heretic. When my palm itches now I accept it as a mild hint that my hands are about due for a more or less vigorous application of soap and water.

Thus as I grow older I note one fond illusion after another disappear. Practically the only one left is a mild belief in the effect exercised by the new moon. I have kept no statistics and therefore cannot state positively that my belief is justified, but I do not consider that any proof is necessary on a point of faith. If it was, I am afraid that the great majority of the human race would find themselves up salt creek without a paddle. We rely implicitly on the statements of others for almost everything we believe. For example millions of people who never have seen the sea believe the water therein is salt. They cannot prove the point from their own experience. If I had the time and if you had the necessary patience and curiosity to follow me I might develop the theme to prove that the mind of a child is plastic in receiving impressions. Usually in some respects it is tenacious and will cling to these impressions through thick and thin, even in the face of the most violent opposition, so long as the mental faculties function at normal capacity.



A LITTLE EXPERT SUPERVISION

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

FACTOR CHART FOR TENSILE STRENGTH

(*Continued from Data Sheet No. 574*)

Size Flat Inches	Factor	Size Flat Inches	Factor	Size Flat Inches	Factor
1/4 x 5 3/4	.928	1/4 x 5 1/2	.727	1/4 x 5 1/4	.610
1/4 x 6	.889	1/4 x 5 3/4	.696	1/4 x 5 1/2	.582
1/4 x 3/4	6.095	1/4 x 6	.667	1/4 x 5 3/4	.557
1/4 x 11/16	5.851	11/16 x 1 1/4	3.012	1/4 x 6	.533
1/4 x 5/8	10.667	11/16 x 1 1/4	2.151	1/4 x 1 1/2	2.370
1/4 x 1/2	8.000	1/4 x 5/8	8.533	1/4 x 1 1/4	2.032
1/4 x 1/2	6.400	1/4 x 1/2	6.400	3/16 x 1/2	5.333
1/4 x 3/8	5.333	1/4 x 5/8	5.120	3/16 x 5/8	4.267
1/4 x 3/8	4.571	1/4 x 3/4	4.267	3/16 x 3/4	3.555
1/4 x 1	4.000	1/4 x 7/8	3.657	3/16 x 7/8	3.048
1/4 x 1 1/8	3.555	1/4 x 1	3.200	3/16 x 1	2.667
1/4 x 1 1/4	3.200	1/4 x 1 1/4	2.844	3/16 x 1 1/4	2.370
1/4 x 1 3/8	2.909	1/4 x 1 1/4	2.560	3/16 x 1 1/4	2.133
1/4 x 1 1/8	2.667	1/4 x 1 3/8	2.327	3/16 x 1 3/8	1.939
1/4 x 1 1/2	2.462	1/4 x 1 1/2	2.133	3/16 x 1 1/2	1.778
1/4 x 1 5/8	2.288	1/4 x 1 5/8	1.969	3/16 x 1 5/8	1.641
1/4 x 1 3/4	2.133	1/4 x 1 3/4	1.829	3/16 x 1 3/4	1.524
1/4 x 2	2.000	1/4 x 1 7/8	1.707	3/16 x 1 7/8	1.422
1/4 x 2 1/8	1.882	1/4 x 2	1.600	3/16 x 2	1.333
1/4 x 2 1/4	1.778	1/4 x 2 1/8	1.506	3/16 x 2 1/8	1.255
1/4 x 2 3/8	1.684	1/4 x 2 1/4	1.422	3/16 x 2 1/4	1.185
1/4 x 2 1/8	1.600	1/4 x 2 3/8	1.347	3/16 x 2 3/8	1.123
1/4 x 2 1/2	1.524	1/4 x 2 1/2	1.280	3/16 x 2 1/2	1.067
1/4 x 2 5/8	1.455	1/4 x 2 5/8	1.219	3/16 x 2 5/8	1.016
1/4 x 2 3/4	1.391	1/4 x 2 3/4	1.164	3/16 x 2 3/4	.970
1/4 x 3	1.333	1/4 x 2 7/8	1.113	3/16 x 2 7/8	.928
1/4 x 3 1/8	1.231	1/4 x 3	1.067	3/16 x 3	.889
1/4 x 3 1/2	1.143	1/4 x 3 1/4	.985	3/16 x 3 1/4	.821
1/4 x 3 3/8	1.067	1/4 x 3 1/2	.914	3/16 x 3 1/2	.762
1/4 x 4	1.000	1/4 x 3 3/4	.853	3/16 x 3 3/4	.711
1/4 x 4 1/8	.941	1/4 x 4	.800	3/16 x 4	.667
1/4 x 4 1/2	.889	1/4 x 4 1/4	.753	3/16 x 4 1/4	.627
1/4 x 4 3/8	.842	1/4 x 4 1/2	.711	3/16 x 4 1/2	.593
1/4 x 5	.800	1/4 x 4 3/4	.674	3/16 x 4 3/4	.561
1/4 x 5 1/8	.762	1/4 x 5	.640	3/16 x 5	.533

(*Concluded on Data Sheet No. 576*)

FACTOR CHART FOR TENSILE STRENGTH

(*Concluded from Data Sheet No. 575*)

Size Flat Inches	Factor	Size Flat Inches	Factor	Size Flat Inches	Factor
3/16 x 5 1/4	.508	1/8 x 5 1/2	.416	1/8 x 6	.333
3/16 x 5 1/2	.485	1/8 x 5 1/2	.397	5/16 x 3/4	2.133
3/16 x 5 3/4	.464	1/8 x 6	.381	5/16 x 7/8	1.829
3/16 x 6	.444	11/16 x 1/2	4.267	5/16 x 1	1.600
11/16 x 1 1/2	1.641	1/8 x 5/8	3.200	5/16 x 1 1/8	1.422
1/8 x 1/2	4.571	1/8 x 3/4	2.667	5/16 x 1 1/4	1.280
1/8 x 5/8	3.657	1/8 x 7/8	2.286	5/16 x 1 3/8	1.164
1/8 x 3/4	3.048	1/8 x 1	2.000	5/16 x 1 1/2	1.087
1/8 x 7/8	2.612	1/8 x 1 1/8	1.778	5/16 x 1 5/8	.985
1/8 x 1	2.286	1/8 x 1 1/4	1.600	5/16 x 1 3/4	.914
1/8 x 1 1/8	2.032	1/8 x 1 3/8	1.455	5/16 x 1 7/8	.853
1/8 x 1 1/4	1.829	1/8 x 1 1/2	1.333	5/16 x 2	.800
1/8 x 1 3/8	1.662	1/8 x 1 5/8	1.231	5/16 x 2 1/8	.753
1/8 x 1 1/2	1.524	1/8 x 1 3/4	1.143	5/16 x 2 1/4	.711
1/8 x 1 5/8	1.407	1/8 x 1 7/8	1.067	5/16 x 2 3/8	.674
1/8 x 1 3/4	1.306	1/8 x 2	1.000	5/16 x 2 1/2	.640
1/8 x 1 7/8	1.219	1/8 x 2 1/8	.941	5/16 x 2 5/8	.610
1/8 x 2	1.143	1/8 x 2 1/4	.889	5/16 x 2 3/4	.582
1/8 x 2 1/8	1.076	1/8 x 2 3/8	.842	5/16 x 2 1/8	.557
1/8 x 2 1/4	1.016	1/8 x 2 1/2	.800	5/16 x 3	.533
1/8 x 2 3/8	.962	1/8 x 2 5/8	.762	5/16 x 3 1/8	.492
1/8 x 2 1/2	.914	1/8 x 2 3/4	.727	5/16 x 3 1/2	.457
1/8 x 2 5/8	.871	1/8 x 2 1/8	.696	5/16 x 3 3/4	.427
1/8 x 2 3/4	.831	1/8 x 3	.667	5/16 x 4	.400
1/8 x 2 1/8	.795	1/8 x 3 1/4	.615	5/16 x 4 1/4	.376
1/8 x 3	.762	1/8 x 3 1/2	.571	5/16 x 4 1/2	.356
1/8 x 3 1/8	.703	1/8 x 3 3/4	.533	5/16 x 4 3/4	.337
1/8 x 3 1/2	.653	1/8 x 4	.500	5/16 x 5	.320
1/8 x 3 3/8	.610	1/8 x 4 1/4	.471	5/16 x 5 1/4	.305
1/8 x 4	.571	1/8 x 4 1/2	.444	5/16 x 5 1/2	.291
1/8 x 4 1/8	.538	1/8 x 4 3/4	.421	5/16 x 5 3/4	.278
1/8 x 4 1/2	.508	1/8 x 5	.400	5/16 x 6	.267
1/8 x 4 3/8	.481	1/8 x 5 1/4	.381		
1/8 x 5	.457	1/8 x 5 1/2	.364		
1/8 x 5 1/8	.435	1/8 x 5 3/4	.348		

Around the World with The Foundry

Little Journeys to the homes of our readers

Ceylon

THE island gem of the tropics, the land of precious stones and spices, of elephants and Buddhist temples, of bread-fruit and banyan trees, of the mingled peoples of India of today and of the wonderful works of a people in the forgotten past. A land which comes first out of the mystery of the years, through a written history traced into the long shadows of time far beyond the beginning of the Christian era.

Situated at the cross roads of the great ocean highways Ceylon is in a favorable position for exporting immense quantities of tea, coffee, camphor, rubber, cotton and other agricultural products and she long has supplied the great bulk of the world's plumbago.

Most of her machinery and metal products are imported but considerable manufacturing is carried on at the capital Colombo which has developed into a great ocean port since the building of the breakwater. The foundry is the base of all manufacturing enterprise and in far off Colombo it is not surprising to find that one of the leading foundrymen keeps himself posted on advanced foundry practice by consulting twice a month the pages of The Foundry.

"Wherever metals are cast you'll find THE FOUNDRY"

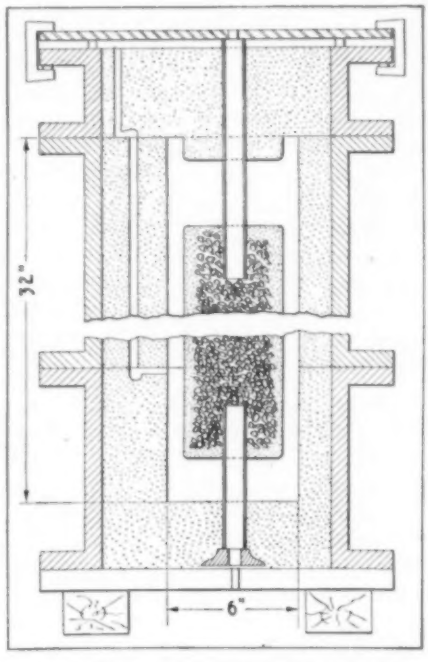
The history of the human race proves that men, in many instances with only a faint conception of what it is all about, will spill the last red drop of their heart's blood in defense of some point of relatively little importance.

I make no claim to such heroic consistency. I merely mention it to illustrate the effect of early impressions and the manner in which they influence our mental horizon. I cannot explain why the moon should be reckoned a potential factor in regulating a man's destiny, but from early childhood I have derived a certain measure of pleasure or anxiety, depending on whether I first observed a new moon over the left or the right shoulder. Go ahead. Laugh if you want to, but before elevating the tip of your nose too highly, just run over mentally a few of your own little pet clinging vines. There's one to laugh off!

In the present instance, as I think I stated previously, I noted the moon over my left shoulder as I rambled over to Bill's house in the dusk of a soft and aromatically tender spring night. I regarded it as a favorable omen that I would find Bill at home and in good trim. I was not disappointed. Usually when he returns from a journey he has some interesting experience to relate and the present instance proved no exception. More for the sake of getting him started than because I wanted an expression of opinion on my superstitious tendencies I referred to the fact that my first glimpse of the new moon had been secured fortunately over my left shoulder.

"You don't mean to tell me" said Bill "that you, a grown man presumably in possession of at least a trifling measure of common sense, you don't mean to stand there and deliberately tell me that you place any credence in any of these silly moonshine legends. My own private opinion is that most of these phantasies about the moon originated in the brain of certain people when they were suffering from an overdose of another species of moonshine. I have it on the best of authority, including my own observation and -er- occasional personal experience, that even a modest indulgence in this exhilerating beverage is capable of playing wonderful tricks with a man's mental faculties. You take my tip, young feller-me-lad, and quit this silly habit of peeping fearfully over your shoulder, or some day you will step into an open coal hole or get bumped into the middle of next week by an automobile. Talking about automobiles reminds me of an experience I had last week.

"In company with another young tourist I made a trip overnight to a city in the southern part of the state to inspect a sand handling installation that was reputed to have revolutionized the methods in a prominent foundry. At one time I would have made the trip on the brake rods, but a belated respect for the proprieties together with consideration for my companion's lack of experience in this mode of travel induced me to travel in style in a sleeper. The long heavy train roared into the town at some unearthly hour about 4 o'clock in the morning, but our car was kicked



SECTION OF ASSEMBLED MOLD

off on a siding and the remainder of the train went hurtling away in the darkness to some unknown point in which I was not interested.

I climbed out of my little nest about 6 a. m. with the dreary prospect of rambling around like a lost soul for a couple of hours. I did not waste any time trying to locate the position of the moon. My only concern at the moment was the problem of finding a place to eat. I walked to the end of the station platform and there I saw something that effectually banished all other considerations. A circus had arrived in the town and I found I was in time to witness the ceremony of disembarkation. I hurried back to the car to announce the glad tidings to my fellow traveler and together we spent a gorgeous hour in watching the procession.

"Finally we decided it was time we were away about the master's business. Under normal conditions we might have had breakfast and then taken a street car out to the foundry and arrived shortly after 8 a. m. Faithful allegiance to his old boy scout motto of one kind act a day, led my partner to call up an old friend to announce his presence in the city. That little innocent call piled us up on the rocks and we did not arrive at the foundry until 9 a. m.

"The friend warned him on no account to leave the station until he arrived. He turned up eventually and the two old friends excitedly went through the usual gymnastics, vocal and physical incident to the meeting of long separated school fellows. I was not particularly interested in the fond reminiscences. I was hungry. As delicately as possible I injected a hint to this effect into the general conversation and the friend in need generously offered to pilot us to his pet eating place.

"After breakfast and further extended reference to the days in dear old Siwash and afterward—reference that excited me to the same approximate extent as a discussion of the last days of the Mohecans—our gallant young saviour magnanimously offered to drive us out to the foundry. We protested vigorously at the idea of imposing on his time, but he insisted that we remain where we were and he would have the old bus around in a jiffy. A jiffy as I have learned through experience is quite an elastic term, but he finally arrived and we started.

"After driving gaily for a few miles he admitted that either he was lost or the foundry was lost. He remembered distinctly passing the place one time last summer just about along here some place.

"You must admit the situation looked serious. Here we were jammed in a Detroit Coop adrift in a large city without a chart or navigating instruments. A drizzly rain was falling from a dark and sullen sky, but the captain stood nobly by the wheel and proposed that we cruise around for some time on the off chance that he might pick up some landmark.

"After some time we approached a filling station and one of the passengers timidly suggested we should hail the attendant and ask him for directions. He came slouching out of his coop but when he learned that all we wanted was information he assumed a mask of bored indifference and remarked he never had heard of the place. In succession we tried several other people and gathered the general impression that not only had they never learned of the existence of

this particularly foundry, but they were quite content to remain in ignorance for the remainder of their natural life. Huh! they were not interested in foundries. Finally we pulled up at a garage and repair shop where the resourceful captain proposed to get in telephonic connection with our objective.

"The proprietor proved to be a rock in a weary land, a shelter in a time of storm. He listened attentively to our tale of woe and then directed a stream of tobacco juice reflectively but in a highly skillful manner in the general direction of a knot hole in the floor. 'Hell' says this angel in disguise, 'You birds is a long ways out of your way but you don't need to do no telephoning. Just take this here street for about a mile 'till you come to a cemetery, then turn to your right for four blocks, then turn to the left and you'll see the place in a little while.' We followed the directions and eventually arrived at our destination.

"That just goes to show" said Bill "that the well meant efforts of friends are not always satisfactory. One time in my young days I had a casting to make on which I anticipated trouble with the core. Here's a sketch of it. You will note that the core is entirely surrounded with iron with the exception of a small opening in the center of one end. In the first attempt I followed the advice of a friend and the casting was a waster. Then I tried a common sense method of my own and secured a perfect casting.

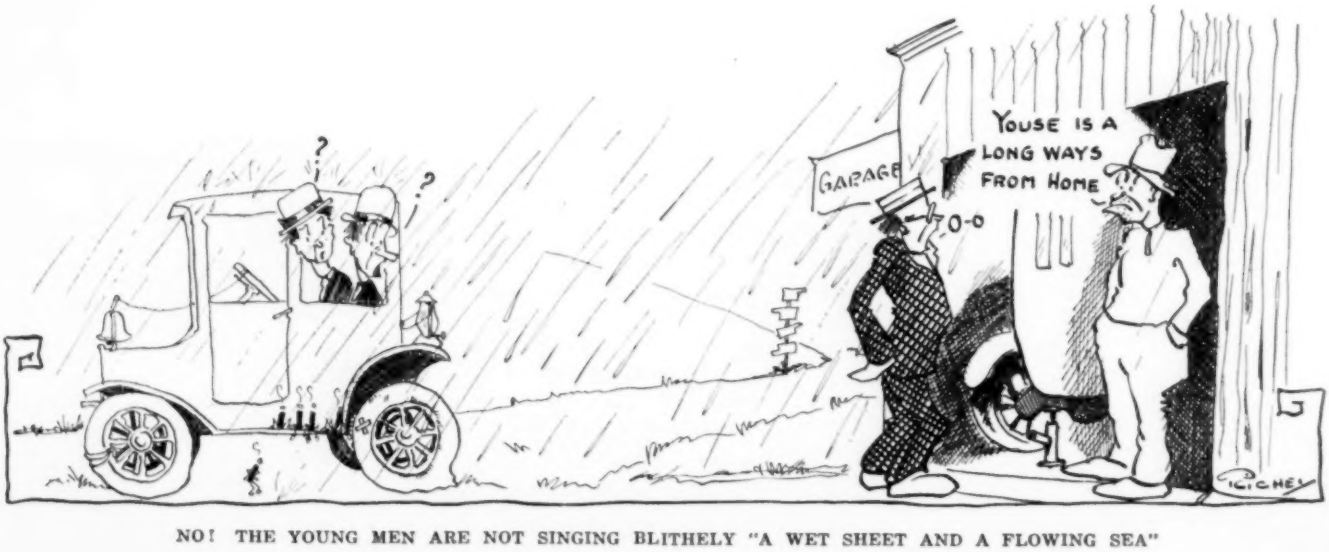
"Later I discovered that provided proper precautions are observed, the casting may be molded either horizontally or vertically, but since the vertical method appeared to be simpler, I followed it the first time. A solid pattern was provided with a 1¼-inch diameter coreprint at each end. The print at one end was attached solidly and the print at the top was attached loosely in a suitable recess in the main pattern. The mold was made in a three-part flask with a gate cut at a tangent about 6 inches from the bottom to prevent the stream of iron from striking directly against the pipe core. The mold might have been made in green sand but since this was a first attempt and because there was only one casting on order, I made the mold in dry sand and dried it in the oven. After the cope was lifted a continuation of the cope coreprint was punched through the cope.

"A plain, half—cylindrical corebox with a half coreprint 1¼ inch diameter, 6 inches long, projecting in at each end was provided for making the core. Sharp sand exclusively, bonded with a minimum amount of binder made a satisfactory core mixture. This was the most important feature of the job. A core for one of these castings must be open and porous, otherwise the metal will boil away from it and cause gas bubbles to form in the casting. A shell of sand about 1 inch thick is sufficient, the remainder of the space in the corebox may be rammed full of cinders.

"After the two halves of the core were dried thoroughly, they were matched and calipered in the usual manner and then laid on the bench joint side up for the reception of the pipe prints. A piece of 1-inch pipe corresponding in length to the prints on the pattern was laid in each end of one half of the core. A channel was cut along the center of the core from one print to the other and few holes were dug here and there to connect directly with the coke. A dab of paste was placed in the prints before the pipes were set in and then a thin coating of paste was placed on the joint of the core all around and also over the pipe. The second half of the core was placed in position and then the two halves of the core were bound together with a strand of wire about 6 inches from each end. The assembled core and pipe prints were given a coat of blackening and then placed in the oven for an hour to expel every trace of moisture.

"In making the mold, an iron washer with a ½-inch hole in the center was rammed under the bottom print to serve as a core seat. A vent wire was pushed through the center and through a corresponding hole in the bottom plate. The greater part of the vent escaped through the upper pipe, but the hole in the bottom served for an auxiliary vent. A little paste daubed on the lower pipe insured a tight fit and prevented the iron from leaking down past the pipe and out through the vent hole in the plate.

"On a job of this kind it is optional whether the core or the cheek first is lowered into place. Usually it is more convenient to lower the core first and then lower the cheek around it. The upper pipe was made long enough to extend to the top of the cope. After the cope was closed, a flat steel strip with a ½ inch hole in the center was laid across the cope in such a manner that it rested on top of the pipe. The ends of the strip were supported on wedges on the upper flange of the cope and also were attached to the same flange by a pair of short clamps. A suitable skim gate was cut at the cope joint and the mold was poured with hot iron. After the casting was cleaned, the pipes were cut off close to the ends of the casting. The lower end was tapped and plugged and the upper hole was tapped in the usual manner for the reception of the plunger rod.



NO! THE YOUNG MEN ARE NOT SINGING BLITHELY "A WET SHEET AND A FLOWING SEA"

Traces Cannon Manufacture-II

Progress Made After Civil War Led to Experiments in Steel Cannon

By Job Goostray, R. F. Harrington and M. A. Hosmer

Fig. 4—Modern 16-inch gun firing at 31 mile range

IN 1860, Mr. Rodman constructed his huge 15-inch cannon and his mammoth powder and cake powder, the last named being quickly adopted throughout the world. These devices proved of great value to the government in the Civil war, and were used widely by both the army and the navy.

During the latter half of 1859, Rodman, who was a captain at that time, carried out exhaustive experiments at the Watertown arsenal to determine the proper quality of iron for casting into a 15-inch gun. As a result of these experiments it was determined to make the gun from remelt Bloomfield iron, which was cast at the Fort Pitt Foundry, 38 tons of iron charged, on Dec. 23, 1859. The casting was made entirely by the Rodman process, it being the first 15-inch gun made. Water circulated through the core arbor at the rate of about 40 gallons per minute, entering at 36 degrees Fahr. and leaving at 60 degrees Fahr. After 24 hours, the core arbor was removed and water circulated through the cavity thus left at the rate of 43 gallons per minute. The time required for cooling was 168 hours. Specimens taken from the chase of the gun gave a density of 7216 and a tenacity of 34,187 pounds.

When the war broke out in 1861, the South Boston Iron Works was called upon to make extensive additions to its plant and to undertake the construction of cannon of much larger bore than had then been made. A new foundry was built and equipped with three air furnaces, each of 45 tons capacity. A large number of 15-inch guns were made, each weighing about 50,000 pounds. Previous to the war, the ordnance work of the government was handled by four foundries, namely the South Boston Iron Works, the West Point Foundry, the Fort Pitt Foundry, and the Tredegar Foundry at Richmond, Va. Other foundries were pressed into service for the war only, and for the construction of guns of small caliber. During the war, the West Point Foundry was devoted to the manufacture of the Parrott gun. The government then was largely dependent on the South Boston Iron Works and the Fort Pitt Works for its heavy ordnance, and the South Boston Iron Works also made large quantities of projectiles, rifle guns and the Schenkl projectile.

The Parrott gun was of a smaller type, being invented by Robert P. Parrott, a former army officer. He was born in 1804 in New Hampshire and graduated from West Point in 1824, about 19 years before Lieutenant Rodman. He was made a captain in 1836 after having fought in the war against the Creek Indians. He was first stationed at the West Point Foundry but in 1839, he and his brother Peter, purchased the Greenwood Furnace and its ore and woodlands from a Mr. Kemble. They experimented there with charcoal pig iron and hooped guns.

The well-known Greenwood charcoal furnace, according to an article by E. C. Kreutzberg in *Iron Trade Review*, July 31, 1924, "originally was about 36 feet high with tuyere arches on each side but none at the back . . . In February, 1839, the bridgehouse and all of the woodwork about the furnace, excepting the waterwheel, supplying power for the blast, were destroyed by fire. In rebuilding, the height of the stack was raised to 42 feet and new blowing machinery was installed. The output thus was increased to about 30 tons of iron a week . . .

"An interesting feature of the operation of the Greenwood Furnace is that it was customary to smelt without any limestone. This was because the native ore to a large extent was self-fluxing. The O'Neil mine yielded ore which could be used without any limestone whatever. The Greenwood Furnace was operated on this ore for a period of two years without any limestone . . .

"One of the interesting achievements there was the casting of guns for the navy in 1855-56 direct from the blast furnace."

R. D. A. Parrott, Flushing, N. Y., in a memoir published a few years ago, describes the operation of the furnace as follows: "The ores were not hauled directly to the furnace, but to a kiln a half mile above it, in which they were roasted to drive off the sulphur. After this they were

SUCCESSFUL use of the cannon in the Civil war resulted largely from the experiments conducted by Lieutenant Rodman and Captain Parrott just prior to the outbreak of the conflict. While progress was steady, since the war period it was not until 1886 *that the first experiments were made on the steel gun. In this article, which is the second installment of a paper presented at the New York meeting of the American Institute of Mining and Metallurgical Engineers, held in February,* 1925, *the authors have traced the developments in the art of gun making from the period just preceding the civil war to the World war. The authors are connected with the Hunt-Spiller Corp., South Boston, Mass.*

put through a stamping mill which reduced the size of lumps to that of a pigeon egg. An important branch in the business was the cutting annually of 10,000 cords of wood and turning it into charcoal."

At the outbreak of the Civil war, Robert Parrott presented his first hoop gun to the government. This proved to be a satisfactory piece, and large orders were placed immediately, which created a big demand for charcoal iron. The Parrott guns began operating at Ft. Sumter and were supplied to the government throughout the war. The Parrott gun was described by Mr. Parrott as "a hooped gun of the simplest kind, composed of one piece of cast iron and one of wrought iron. It had no taper, no screw, no successive layers of hoops. It was, however, no hasty expedient, but was devised upon the results of years of experience and practical trials, and had a definite and consistent plan." In fact, it was a gray iron rifle with a wrought-iron band to reinforce the breech.

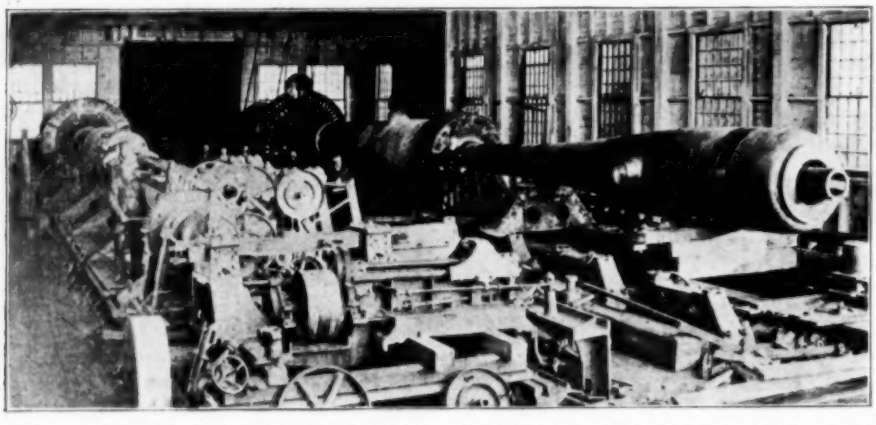


FIG. 5—MACHINING A 12-INCH BREECH LOADING 54-TON RIFLE AT THE SOUTH BOSTON IRON WORKS IN 1884

Both the army and navy departments insisted on charcoal iron made by the cold blast method, and a Lieutenant Walker of the navy was stationed at Greenwood to see that this method was the one used. As the men at the furnace were used to the hot blast and desired to run the furnaces accordingly, a valve was constructed whereby the air could be readily shifted through the heater or not as desired. A foreman later related that it was customary to run on hot blasts until "Lieutenant Walker was seen coming around a bend in the road, whereupon the valve was closed and the furnace put on cold blast. The hot blast was about 120 degrees Fahr., the maximum then obtainable."

During the period of depression through which ordnance concerns had to pass shortly after the war, the Fort Pitt Foundry closed its doors, and since the West Point Foundry was adapted for making guns of smaller caliber only, the government became more and more dependent on the South Boston Iron Co. for heavy ordnance. The master mechanic at that plant came forward about this time with an important improvement in the manufacture of bronze cannon and a patent was granted to him in 1869 for his invention. This improvement consisted of a method whereby the interior metal of the cannon was made more dense, thus increasing its strength and wear. After the piece had been bored and rifled, a mandrel of slightly greater diameter than the bore was forced in by hydraulic pressure, following which others of increasing size were forced into it. This, of course, renders the metal near the bore of greater density and consequently of more resistance to abrasion in firing. Bronze cannon made by the usual method wear rapidly, especially if rifled. However, by Dean's method, they became as durable as steel guns.

In Mr. Hunt's article in the *Iron Molders' Journal*, it is stated that immediately after the Civil war large orders for guns and ordnance were received by the South Boston Iron Works for South American republics. About 1867, war was declared between Spain and Chile and Mr. Hunt, who was an official of the South Boston company, says, "We shipped three 1000-ton cargoes to Chile within the period of six months; also large shipments to Peru later on, and ten 25-ton Rodman guns to Argentine Republic. Our contract with the Argentine Republic was 'free on board at Boston' and the guns were promptly shipped to Buenos Aires. When the captain returned to Boston, we learned that the officials there had no means of taking the 25-ton guns from the vessel, and to avoid damage they concluded it would be economical to pay the captain $60,000 for his vessel and send him home."

In 1875, the South Boston Iron Works cast a 12-inch steel lined rifled gun under the patent of Nathan Thompson, Brooklyn, N. Y. It weighed 80 tons when cast and 45 tons when finished and was breech-loading.

During 1877, a muzzle-loader cast iron gun lined with wrought iron was made by this company and was the largest gun ever cast up to this time. It was rifled and weighed 45 tons when finished. The wrought iron tube weighed 13,000 pounds and the gun itself 77,000 pounds. It fired a 600-pound shot.

First Gun Weighed 28 Tons

Apparently the next contract given out for cast iron guns was one for two guns of 10-inch caliber, and two of 12-inch caliber, to the South Boston Iron Works, in 1880. Owing to the extensive preparations necessary in the work of casting these guns, they were not completed until 1884. A detailed description of the casting appeared in THE FOUNDRY, January, 1918. The article was written by Job Goostray, assistant to James Wood who had charge of the work. Mr. Wood was foreman of the ordnance casting department of the South Boston Iron Works.

The first gun was cast by the Rodman method and when finished was 25 feet long and weighed 28 tons. It was taken to the Watertown arsenal to be wound with wire, and was known as a 10-inch wire-wound rifle.

The second gun was to be a 12-inch breech loading rifle to be cast breech up. This also was cast by the Rodman process and when finished weighed 54 tons and was 30 feet long. A contract was made with a building mover to remove the gun from the pit and place it in the lathe for the sum of $550. It took the contractor five weeks to accomplish the work.

The third gun was also a 12-inch breech loading rifle and was to be cast breech down. It was the heaviest gun cast in the United States up to that time. This was not as successful as the two previous castings, for about an hour after being cast, the flask gave way, the iron going to the bottom of the pit. As there were approximately 120 tons of iron involved in the casting, there was quite a loss represented by the accident. The result is shown in Fig. 7. This caused some delay in carrying out the work and it was not until October, 1884, that work on the

contract was resumed. The next gun attempted was one of the hoop and tube type. The casting weighed approximately 76 tons and was entirely successful.

Work was again begun during the following month on a 12-inch breech-loading rifle similar to the one that caused the trouble before. This was cast successfully but was rejected by the government because of a small crack in the interior discovered during the machining process, which was apparently due to too rapid cooling. Likewise, another gun of this type, cast in August, 1885, proved defective, because of the washing away of the coating of the core arbor, which allowed the iron to get into the interior.

During the early part of 1886, a successful casting of this model was made. The mold was filled in 33 minutes and was allowed to cool slowly for several days. After the South Boston Iron Co. had completed this contract, work was started on 30 breech-loading mortar bodies. These averaged 18 feet long, 34 inches diameter, and weighed over 20 tons each.

Cast Larger Guns

Frequent reference has been made to the large 15-inch guns, and it is interesting to note that this caliber is close to the upper limit even on the modern gun. However, the Fort Pitt Foundry did cast two 20-inch guns at one time, one for the army and one for the navy. The former weighed 116,497 pounds and the latter 100,000 pounds. Each cannon fired a 1000-pound shot. Artillery as large as this did not prove practical, and these guns became much more interesting than useful. It is also interesting to note, in connection with the large diameters, that the Fort Pitt Foundry also made 150 18-inch mortars, which were more in line with the abilities of the foundries at that time but were never adopted by the government to any great extent.

In May, 1885, there were available for seacoast defense the following smooth-bore Rodman guns: two 20-inch; 318 15-inch; 998 10-inch; 210 8-inch. In addition, there were 210 10-inch Rodman guns that had been converted to 8-inch rifles by the insertion of a steel liner. There were also available for the defense at this time 38 300-pound, 81 200-pound, and 173 100-pound rifled Parrott guns. A report indicates that these Parrott guns were of doubtful strength.

By act of Congress, March 3, 1885, the President of the United States was authorized to appoint a board of which the secretary of war became a member and president. This board was called Board on Fortifications or Other Defenses. The purpose of this board was to examine and report the conditions as found to exist at the various forts, fortifications, or other defenses, and to determine the character and kind of equipment most urgently required and best adapted for each with reference to armament, etc. An extensive program was prepared by this board, taking in defenses of the whole United States, not only seaboard cities but also lake ports. This program recommended appropriations for the manufacture of 6, 8, 10, 12, 14 and 16-inch guns and 10 and 12-inch mortars with the carriage, emplacements and accessories.

In connection with this system of coast defense, a contract for 50 12-inch breech-loading rifle mortars, with a cast iron body, and steel hooped, weighing 14¼ tons, was placed with the Builders' Iron Foundry, Providence, R. I., and orders for the finishing and assembling 73 of these mortars were likewise placed with that company.

Accordingly to a booklet published by the Builders Iron Foundry, "these mortars in appearance closely resemble the steel breech-loading rifles made by the United States navy department, with the exception of their length, which in the rifles is about 30 times the diameter of the bore and in the mortars only ten times." The bodies were to be made of charcoal iron and cast breech downward. The outside diameter over the steel hoops, which were shrunk on the bodies in two rows, was 42½ inches. A complete description of the casting and specifications for these mortars is given in the booklet published by the Builders' Iron Foundry.

The Builders' Iron Foundry had been prominent during the Civil war in ordnance manufacture and had since from time to time received important contracts for government work; this comparatively large contract for Rodman guns was practically the last order for cast-iron guns. There were, of course, many 8, 10, 12 and 16-inch guns to be built in connection with the recommendations of this defense board, and it was at this point that the ordnance engineers and experts began to realize the limitations of cast iron and consequently began to turn their attention to the manufacture of steel guns. This was because the casting of cast iron guns was a matter of trial based upon previous experience and thus became more or less of a rule of thumb method, while in the case of steel it became a matter of an exact science in that the physical properties of the steel could be predetermined by calculation. However, in 1885, there was no plant in the United States capable of making forgings for guns of more than 6-inch caliber.

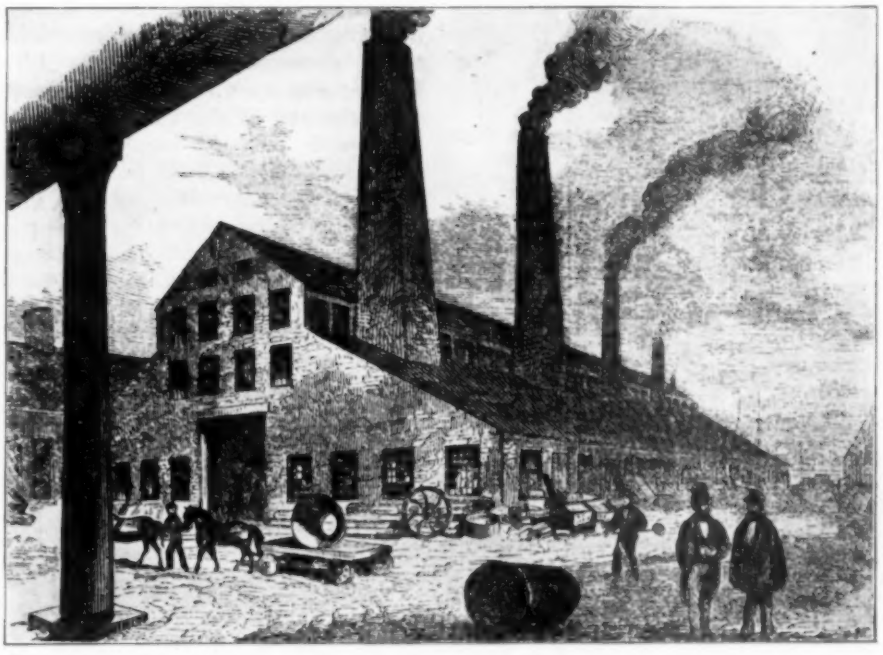


FIG. 6—EXTERIOR VIEW OF THE CASTING HOUSE OF ALGER'S FOUNDRY

Some time previous—1883—a group of men known as the Endicott board was appointed to investigate the gun and steel establishments in the United States and abroad. This board recommended that the United States government maintain gun factories capable of turning out the larger caliber after the most approved pat-

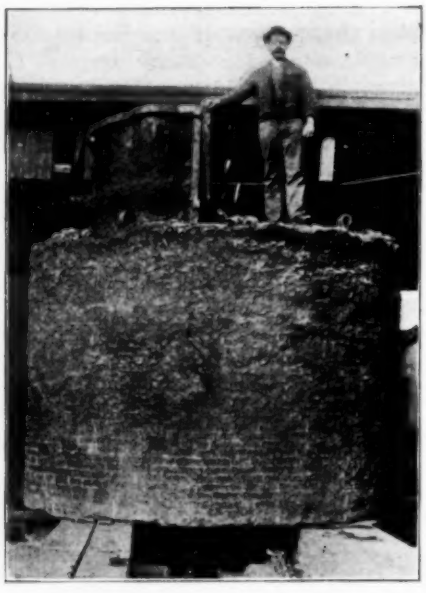


FIG. 7—120 TONS OF METAL SOLIDIFIED IN THE BOTTOM OF THE PIT

terns and that private firms be encouraged in making steel forgings and material for guns. Therefore, in 1886, $4,000,000 was appropriated for a steel armor plant and $2,128,000 for guns. The Midvale Steel Co. and the Bethlehem Steel Works were given contracts for forgings and each undertook the manufacture of 100 guns of various calibers, these guns being practically all called *model of* 1886.

From this date the steel alloy gun came into existence in the United States as a means of defense for the coast and lake ports. It was to take the place of the cast iron Dahlgren and Rodman guns which heretofore had been the armament of the defenses.

Capt. E. E. Hobbs, ordnance department, made some investigations of hollow steel forgings that were cooled from the interior during the process of manufacture. This was with a view of introducing internal strains, which would be helpful in opposing interior pressure on the cylinder. He also investigated the process of shrinking hoops over cylinders or tubes for the purpose of accomplishing these same results. This experiment was carried out in 1892 on a tube whose wall thicknesses were practically that of a 3.2-inch field gun. A careful examination of these guns so manufactured indicated that the initial strains were properly disposed, varying from compression at the bore to extension at the interior.

This forging was given a thorough physical test by cutting off rings and specimens. It developed physical characteristics that left no room to doubt that initial tension strains of as great intensity as are desirable could be produced in a hollow forging. Experiments also indicated that if these strains should be more than were required they could be reduced by annealing.

All modern high-power guns are made of steel and are composed of several parts united to form a whole with the parts so arranged as best to support the stresses upon them. Therefore the gun is called either a *built-up* gun or a *wire-wrapped* gun.

To obtain an initial compression of the tube or inner member of a built-up or wire-wrapped gun, an exterior pressure is exerted by placing over the tube a cylinder or hoop whose interior diameter is slightly less than the exterior diameter of the tube. After heating and upon cooling, it contracts the tube and if the difference of diameters is properly regulated it will produce the required pressure and thus initial compression of the tube. The compressing and strengthening of the tube, however, will in some measure extend and weaken the hoop shrunk on the outside, but this extension or weakening when properly regulated may be supported without damage to the structure. In other words, the modern cannon is made of concentric cylinders shrunk one upon another, the object of this method of construction being twofold; first, the attainment throughout the steel of each cylinder of soundness and uniformity of metal, and second, the best results according to the theory of gun construction. The steel employed in the making of guns must be of the highest quality and the finest grade. It requires the most expert knowledge of steel manufacture.

The 16-inch 50-caliber gun is the largest and most powerful piece of ordnance in the United States at the present moment and with an elevation of about 54 degrees and a powder charge of 850 pounds, and a projectile weighing 2340 pounds, will have a maximum range of about 31 miles. This is a wire-wound gun 70 feet overall and weighing with breech mechanism and recoil band 385,847 pounds. The velocity of rotation of the projectile as it leaves the muzzle, due to rifling, is 1620 revolutions per minute. The material used in the construction is alloy nickel steel having an elastic limit of 65,000 pounds per square inch. The wire used is 1/10 inch square, cold-rolled alloy steel. It is wound on the gun at a stress of 50,000 pounds per square inch.

In a gun of this length, due to its weight and elasticity of the metal, there is a droop, when the gun is in a horizontal position and supported in its cradle, of anywhere between 0.5 and 0.6-inch.

The magnitude of the construction of a gun of this size may more readily be understood by the size of the ingots and forgings which are approximately as follows:

	Ingot, pounds	Forging, pounds
A tube	194,112	48,528
B tube	275,992	68,998
C hoop	91,536	22,884
D hoop	315,532	78,883
E hoop	162,508	40,627
Jacket	123,328	30,832
Breech block	10,768	2,692

The accuracy life of some of the cannon now in the United States without requiring relining is as follows:

	Rounds
75-millimeter gun	10,000
3-inch gun	5,000
4.7-inch gun	5,000
155-millimeter gun	2,500
155-millimeter howitzer	7,000
240-millimeter howitzer	6,000
5-inch seacoast guns	1,000
6-inch seacoast guns	1,000
8-inch seacoast guns	800
10-inch seacoast guns	700
12-inch seacoast guns	600
14-inch seacoast guns	400
16-inch seacoast guns, 50 calibers	100

However, it is probable that cannon can be fired to about 50 per cent above these figures before relining.

This resume on guns would not be complete without mentioning the greatest achievement of the twentieth century, the long-range gun developed by the Germans and used by them in shelling Paris in 1918. This cannon had the characteristics of abnormal range and used a projectile grooved to fit the rifling of the gun. It is probable that a 381-millimeter, 45-caliber naval gun was retubed to a diameter of 210 millimeter, which will give the length of this gun about 140 calibers.

While the powder used is yet in

(*Concluded on Page* 461)

FIG. 8—THE FOUNDRY ADVERTISED WITH CIRCULARS

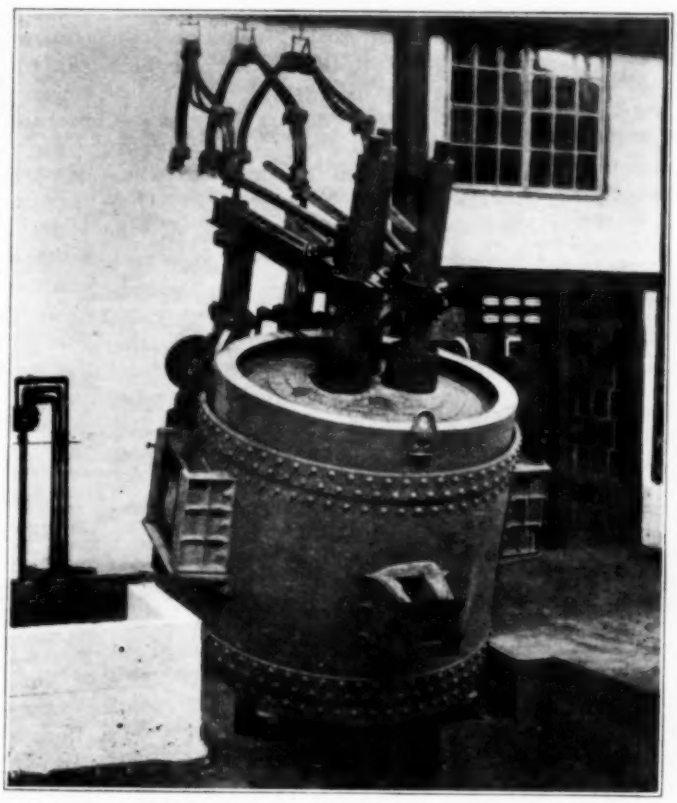
Develop New Furnace

For

Steel and Iron Foundry Service

PRIMARILY designed for melting steel under conditions that approached the ideal as nearly as possible, the electric melting furnace has been modified by various makers in many respects in recent years and now is employed quite freely in melting nonferrous metal in addition to iron and steel. This is all the more remarkable in view of the fact that the first electric furnace was perfected in Italy only about 25 years ago. It was not until 1908 that the electric steel furnace was employed in the United States for the manufacture of steel castings. Now it is reckoned the second largest melting medium. From an initial output of 55 tons in that year the amount steadily has increased until at present the amount of steel melted electrically is approximately 16 per cent of the total steel poured into castings in this country. Sentiment for some time among foundrymen, particularly foundrymen closely connected with the metallurgical phases of the industry, has been inclined toward the adoption of the electric furnace as a supplementary or refining medium to be used in conjunction with the cupola, open hearth or reverberatory furnace, in which the iron, steel or malleable iron is melted originally. Probably in the great majority of instances, castings poured from metal melted in any one of the three foregoing types of furnaces, are fairly satisfactory. They meet existing specifications. However, the tendency constantly is toward still more exacting specifications. Competition among foundrymen has created a rivalry that finds its expression in the production of increasingly better castings. In some instances customers insist on a chemical analysis, physical properties and molecular structure not possible of attainment in any form of melting unit with the single exception of the furnace in which electric current is employed to raise the temperature of the metal to any point within reason.

The latest design of electric furnace for melting steel and iron, recently has been erected and placed in operation in the foundry of the Bingham & Taylor Co., Buffalo. The basic features and general appearance of this furnace do not differ to any material extent from other electric furnaces at present on the market. However, the general construction features and operating mechanism present many points of difference including high electrical efficiency.



GENERAL APPEARANCE OF THE 1½ TON ELECTRIC FURNACE ALL SET UP AND READY FOR OPERATION

The present furnace represents the crystallized ideas of J. W. Gibney Sr., his son James L., and David McLain collected over a period of several years both in this country and in Europe. Mr. Gibney has been foundry manager of the Bingham & Taylor plant for over 20 years and for a considerable part of that time has made steel castings by the electric furnace process. James L. Gibney was given a course of training common enough in the great engineering plants of Europe, but not practiced to any great extent in this country. He was sent through the drawing office, the foundry, the pattern shop and the machine shop. His education was rounded out by practical operating experience on the electric furnace, a metallurgical course at Cambridge, Mass., and a year's trip to Europe.

Before going to Europe he had visited typical electric furnace installations in this country, and had noted their operating and equipment features. On his return the mass of accumulated information was analyzed, tabulated and the various related items were set up for comparison. The result is the furnace shown in the accompanying illustration. It has a rated capacity of 2500 pounds, but plans have been prepared for two additional sizes, one of 1000 pounds and the other for 6000 pounds. Mr. Gibney's preliminary training enabled him to make his own drawings, patterns and castings and later to assemble the furnace and place it in operation. David McLain has been connected with the steel and iron foundry interests for over 50 years and is widely known through his teaching and consulting contacts. The furnace is mounted on rockers through which it may be tilted forward a sufficient distance to drain the hearth. It may be tilted backward a sufficient distance to receive hot metal either from the cupola or any other form of furnace at the pouring spout. The electric control for the tilting mechanism is attached to a column directly in line with the spout, but at a convenient distance across the main bay of the foundry. From this point it may be controlled clear of flying sparks.

The furnace is of the direct-arc type used for making a general run of iron-carbon alloys, alloy steel and metal requiring high melting temperatures. It is adapted equally to acid

or basic melting and may be alternated to make heats of gray iron or steel.

Drawing from their extended experience as practical steel makers, the designers paid particular attention to the little incidentals which have a direct bearing on the production of good steel. These include the roof coolers, electrode holders, the doors and many other features which in the long run exert an important influence on the melting costs. The furnace is built substantially and heavily reinforced to insure long life. The shell or furnace body proper is built of extra heavy steel plate, strapped and reinforced with steel castings. The installation is quite compact and aside from the transformer house does not occupy much space on the foundry floor.

On the assumption that a melter's time should be spent directly on metallurgical problems and not upon nursing and regulating mechanical features on the furnace, the mechanical equipment of the furnace has been made as simple and fool proof as possible.

The upper part of the furnace commonly called the mast and jib is specially designed for low overhead clearance. The superstructure or electrode cranes travel below the furnace floor. The electrode cranes are driven and controlled by a special device which automatically relieves the load should the electrodes encounter undue opposition while penetrating bad charges of scrap. This device disengages the feed and prevents the electrodes from breaking. Suitable devices have been provided on the electrode cranes for adjusting or regulating them to conform to the variable position of the roof center. Importance is attached to this feature because sometimes the roofs are improperly built.

Loads Counterbalanced

Adjustments may be made away from the heat zone. If necessary the electrode cranes may be swung clear of the furnace body. The electrode cranes supporting the holder, electrodes, steelwork, castings and copper conductors all are counterbalanced. The counter weights are placed in a remote place in the transformer room. This balanced crane reduces the load while on the downward travel and also permits the use of smaller motors for the electrode lift.

To reduce friction to a minimum, the cranes have been designed to ride between large self inclosed ball bearing rollers. The large surface area of the rollers enable them to turn with the slightest movement of the crane. The rollers are mounted in a special adjusting device to take up any play that may develop after an extended period.

An air-cooled, electrode holder is an original feature of the installation. It presents rapid means of clamping, flexibility and high electrical conductivity. It is claimed that absence of water on the holder and superstructure permit better operating conditions since there are no joints or valves to get out of order. The roof cooler or electrode gland has been designed to insure low electrode consumption. It has large water area, self sealing joint and lightness. The sealing joint prevents an emission of flame or air drafts around the cooler.

Charging doors on two opposite sides are large and of heavy construction and are raised and lowered by a counterweight sliding in a fixed tube attached to the furnace shell. These self sealing doors are operated easily by the melter himself. He needs no helper to assist him while taking his necessary tests on the heat. The pouring spout is arranged to provide a clean tap into the ladle. The slag is held back until the last thus assuring metal comparatively free from slag inclusions.

The furnace operates on 3-phase, polyphase, 25 cycle current at 2300 volts. The power is furnished by the Buffalo General Electric Co., Buffalo. In melting steel, the furnace operates on 120 volts while melting and on 100 volts during the subsequent refining process. One voltage of 120 is used throughout when making plain carbon steel.

Automatic regulators of the Thury type have been adopted as standard equipment on this installation. Hand wheels are provided to be used in the event any trouble develops with the electrode motors, or at any point in the power line. The electrical layout functions admirably from the point where the current enters the transformer house to the electrodes and works in perfect unison with the mechanical installation. The electrical efficiency of this furnace is high, represented by a power factor of 95-97 per cent.

For some time past the furnace has been in steady operation making from three to six heats each 8-hour day. A charge of 2500 pounds of steel scrap is melted in a period of between 35 and 50 minutes. The total period of each heat including the time necessary for refining the metal is between 60 and 75 minutes.

The castings made by the Bingham & Taylor Co., demand a high grade steel and the policy of the management is to pay great attention to the refining period where the condition of the slag and metal are adjusted carefully. If necessary, steel may be melted rapidly for an inferior grade of castings, but the furnace builders advocate careful refining with well made slags after the melting operation.

Special heats of cast iron are made from cold stock in 50 minutes. They are made on the same lining employed when melting steel. Part of the general routine includes taking from 1 to 3 tons of hot metal from the cupola and refining it in the electric furnace. Results obtained from this practice have been exceedingly interesting and at present the designers are developing a method for producing a special iron for the automotive industry.

On steel heats the average power consumption is 625 kilowatt hours per ton and on cast iron heats the consumption is 500 kilowatt hours per ton. From 3 to 7 tons of high grade electric steel are poured per day into all kinds of automotive castings, valves, fittings and general jobbing work. The company also pours from 50 to 75 tons of cupola melted gray iron into general pipe castings, valve extension boxes, railroad pedestals and oil boxes.

Temperatures Control Quality of Brass

(*Concluded from Page* 437)

Silicon in a brass containing lead should not be used as a deoxidizer. It should never be considered in any copper alloy where electrical conductivity is one of the properties desired.

Fortunately for the industry, we are disregarding more and more the traditions which have been prevalent among foundrymen for decades. We are beginning to realize that there is nothing supernatural about the workings of a foundry and that the supposed mysticisms which have been handed down from father to son and they in turn to their sons and so on down the line are purely and simply imaginative and things of the past. Foundrymen realize today that they can account for practically everything that occurs in a foundry. They realize today that all of the processes of manufacture in a foundry are based upon good sound principle and theory. Upon this foundation have they built an industry that is gaining its deserved recognition from the world of science, art and business.

Patternmaker Finds Use for *Special Cutting Tools*

Draw Knife, Corner Rounding Tool, Router, Spoke Shave, Fillet Plane, etc., Find a Place in the Kit of the Expert Workman

By Walter C. Ewalt

WHILE the use of various types of planes previously has been described, a number of tools, due to their form and the type of work for which they are used, may be classed as special plane cutting tools. Included in this class are the draw knife, corner rounding tool, router, spoke shave, fillet planes and various circular plane-like tools.

The draw knife, shown in Fig. 1, in reality is a chisel, but instead of being pushed or driven into the wood, is drawn or pulled. The handles, unlike the chisel, are in front of the cutting edge. As a handle is provided at each end of the blade, both hands are necessary in the operation of this tool, the work being held in a vise or clamped to the bench. The tool is ground in the same manner as the chisel, the bevel being ground on one side only, the other side being left perfectly flat. The draw knife is used principally as a roughing tool, since it cuts fast on narrow or rounding surfaces. When roughing out work, the flat side may be held upward and rather short strokes taken. However, when working down to a line, the flat side is down, since it helps to guide the tool.

Some of the draw knives have folding handles, which, when folded over, protect the blade and makes a neater and more compact tool. The tool is held solid with one hand when sharpening, the whetstone being moved back and forth with the other hand. This tool may be obtained in a number of sizes, the size being governed by the length of the blade.

The corner rounding tool is shown in Fig. 2. Many other tools, such as knives, block planes, etc., may be used to round corners, in each case it being necessary to mark the wood on each side of the corner. This tool comes in different sizes, for example one 5½ inches in length with 1/16 and ⅛-inch cutters at the ends or one 5½ inches long with 3/16 and ¼-inch cutters. It is possible to make a cut without any depth gage mark with this tool. It is handy for rounding ribs, etc., which constitutes a considerable portion of the work of the patternmaker. The tool either may be pushed or pulled as the cutter is sharpened both ways. The amount to be cut may be regulated by tipping the end up or down. Corners on straight, concave or convex work may be removed.

A convenient tool which may be made in the shop of wood fiber is a set of templets for making fillets and round corners. The templets, which are shown in Fig. 5, may range in size from ⅛ to 2-inch radius. When making a round piece of wood, the patternmaker usually draws a circle on the end of the work. He then sets a bevel at an angle of 45 degrees and with the edge of the

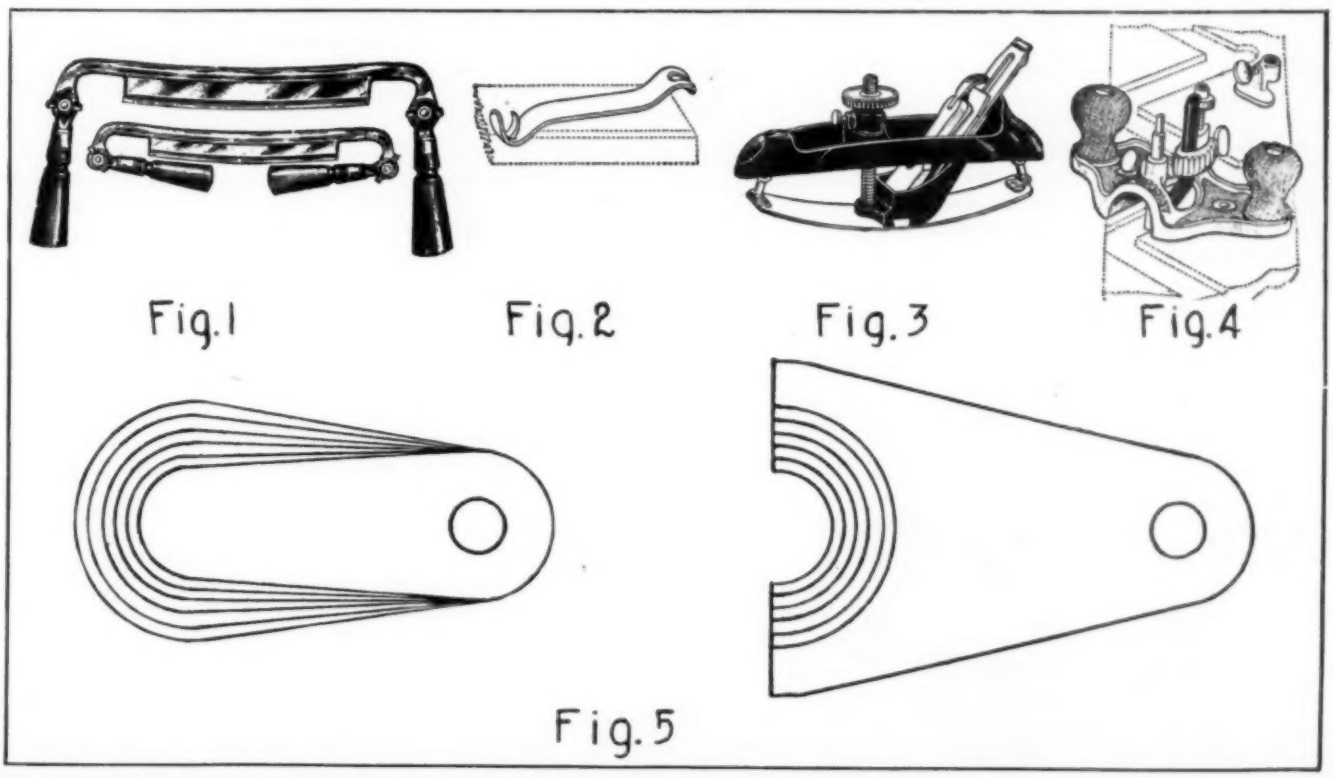
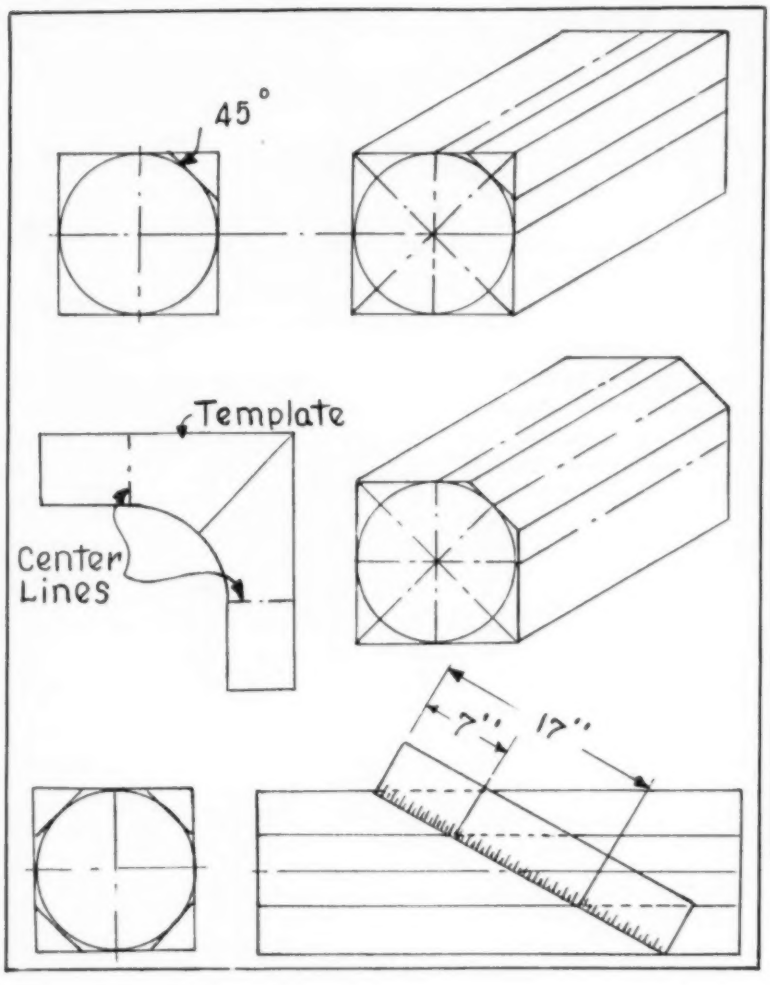
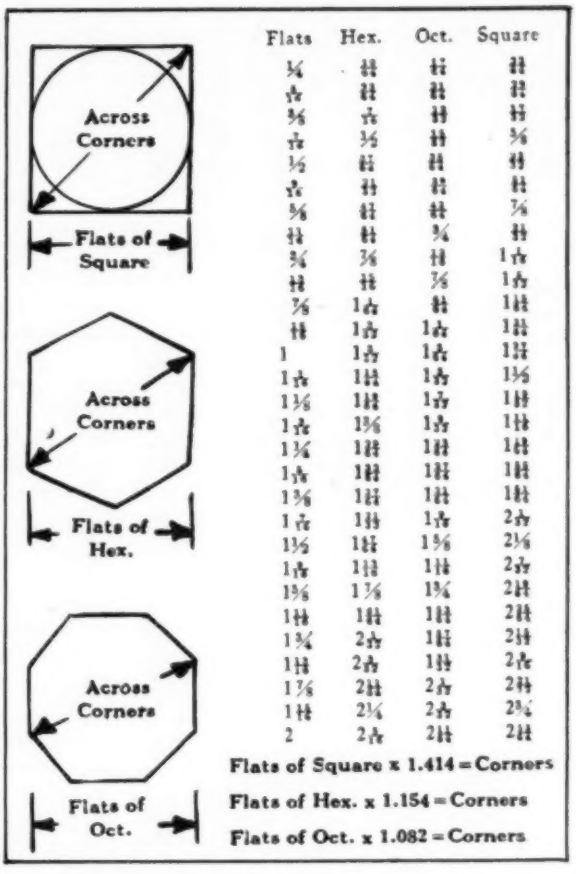


FIG. 1—FOLDING HANDLE DRAW KNIFE. FIG. 2—CORNER ROUNDING TOOL. FIG. 3—CIRCULAR PLANE HAVING AN ADJUSTABLE SOLE. FIG. 4—ROUTER SHOWING OPEN THROAT. FIG. 5—TEMPLETS FOR MAKING CURVED SURFACES





Flats	Hex.	Oct.	Square
¼	¼	¼	¼
5/16	5/16	5/16	5/16
⅜	⅜	⅜	⅜
7/16	7/16	7/16	7/16
½	½	½	½
9/16	9/16	9/16	9/16
5/8	5/8	5/8	5/8
11/16	11/16	¾	¾
¾	¾	13/16	1 1/16
13/16	13/16	13/16	1 1/16
⅞	1 1/16	⅞	1 1/8
15/16	1 1/16	1 1/16	1 1/8
1	1 1/16	1 1/16	1 1/4
1 1/16	1 1/8	1 1/16	1 5/16
1 1/8	1 1/8	1 1/16	1 3/8
1 3/16	1 5/16	1 5/16	1 3/8
1 1/4	1 3/8	1 3/8	1 7/16
1 5/16	1 3/8	1 3/8	1 7/16
1 3/8	1 7/16	1 7/16	1 1/2
1 7/16	1 1/2	1 1/2	1 9/16
1 1/2	1 9/16	1 9/16	2 1/16
1 9/16	1 5/8	1 5/8	2 1/16
1 5/8	1 5/8	1 5/8	2 1/8
1 11/16	1 11/16	1 11/16	2 1/8
1 3/4	2 1/16	1 11/16	2 1/8
1 13/16	2 1/16	1 13/16	2 3/16
1 7/8	2 1/8	2 1/16	2 1/4
1 15/16	2 1/8	2 1/16	2 1/4
2	2 1/16	2 1/8	2 1/8

Flats of Square x 1.414 = Corners

Flats of Hex. x 1.154 = Corners

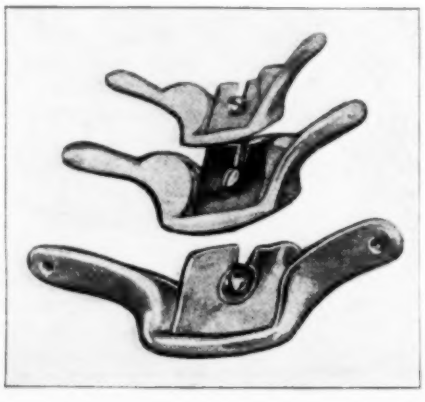
Flats of Oct. x 1.082 = Corners

FIG. 6—METHOD OF MAKING A BLOCK ROUND. FIG. 7—LEFT BELOW—LAYING OFF 45 DEGREE ANGLE WITH RULE. FIG. 8—ABOVE—TABLE SHOWING DISTANCES ACROSS CORNERS

bevel on the circle, draws a 45-degree line. At the ends of the line he scribes a line lengthwise on the work and proceeds to cut the edge at a 45 degree angle. This gives three points from which to work, namely the center lines and the center of the angle.

A templet made of ¼ or ⅜-inch wood is used as the patternmaker proceeds to work off the stock between the center of the 45 degree and the center lines. When the stock is nearly round, the patternmaker chalks the templet and the wood then is cut off where the chalk marks show. If the end is such that the circle cannot be marked, the 45-degree angle may be marked off by using a 2-foot rule or scale. As shown in Fig. 7, the ends of the scale are placed even with the edge of the block, and lines drawn at 7 and 17 inches. An octagon is made by this method and the inscribed circle is the diameter across the flats. If the portion of wood between the center of the flats is removed, the largest circle possible is worked and the wood is made round. An article on fillets which appeared in THE FOUNDRY, Nov. 15, 1924, gives a table by which corners may be marked.

Another homemade tool, similar to the corner rounding tool and useful in roughing off wood is shown in Fig. 11. This may be used on straight, concave and convex surfaces to a good advantage. One of the most important tools found in a patternmaker's kit is a router which is shown in Fig. 4. This is a form of plane and is used to surface the bottom of grooves, which are parallel with the surface of the work. The throat is open in the illustration enabling one to see the



SMALL SIZE

Length overall ..... 3⅞ inches
Width of blade ..... ⅞ inches
Bottoms rounded to about a 4½-inch diameter circle.

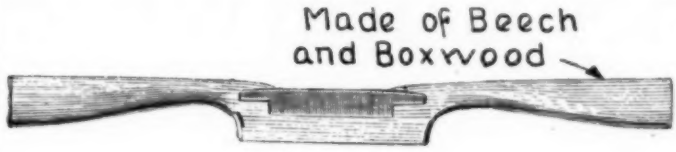
MEDIUM SIZE

Length overall ..... 5¼ inches
Width of blade ..... 1¼ inches
Bottoms rounded to about a 6½-inch diameter circle.

LARGE SIZE

Length overall ..... 6½ inches
Width of blade ..... 1¼ inches
Bottoms rounded to about 10½-inch circle.

FIG. 9



AMERICAN NARROW BLADE SHAVES

Length of blades .....1½, 1¾, 2 and 2½ inches

ENGLISH BOXWOOD SPOKE SHAVES

Sizes, overall .....4, 5, 6, and 7 inches

Length of blades .....1, 1, 1½ and 1½ inches

FIG. 10

work and cutter, and also permitting the chips to free themselves. It has an attachment to regulate the thickness of the chip and another attachment to close the throat for use on narrow surfaces.

Usually the patternmaker screws a board about ½ x 4 x 12 inches on the sole of the router which gives a wider range on large openings. The cutters have a screw adjustment and may be held on either side of the post. If put opposite from that shown in the illustration, the cutter may be used to cut in advance of the frame of the router. This is called bull nose work. This often is an advantage due to some obstruction in the pattern. It allows the frame to go only so far while the slot may continue. This tool is handy in making depressions for dowel and rapping plates, set in dovetails, monograms, different kinds of joints such as lap, dovetail, notched, checked, forked, rabbit dado, dado rabbit and many others which will be described in a future article. The router differs from an ordinary plane since the cutter must be adjusted for depth for each cut.

The spoke shaves shown in Fig. 9 are tools which probably derived their name from the fact they were used to cut shavings from spokes for wheels. This tool is used considerably by patternmakers, often to rough off the work, although a good smooth surface may be obtained if desired. The tool is a form of plane, but with its small surface of bottom or sole, it is difficult to make a straight surface. Therefore, it is used principally to make curves, corners and in forms where it is difficult to use a bench plane. There are many forms of this tool in straight, round and hollow designs. A good, fast-cutting, roughing spoke shave, sometimes known as a beltmaker's spoke shave, with a blade which is round from right to left, is a desirable tool. The small compass spoke shaves in which the sole of the spoke shave is round in two directions, that is from front to back and from left to right, are good to work out reducing elbow and the volute of centrifugal pump coreboxes and in work of like nature. A large amount of circular work, which cannot be turned, is done with a straight spoke shave. These tools are made of aluminum, iron, brass and wood. Many workmen prefer those made of boxwood, or beech which have no metal except the blade.

A few patternmakers use a fillet plane for cutting leather fillets. This plane has a thin blade the shape of a fillet. The fillet in this case is the shaving formed by the plane. However, it is cheaper to buy fillets already cut.

A circular plane having an adjustable sole for planing on the inside or outside or circles occasionally is seen and is illustrated in Fig. 3. The table showing distance across the corners of squares, hexagons and octagons, which is given in Fig. 8, will be found useful.

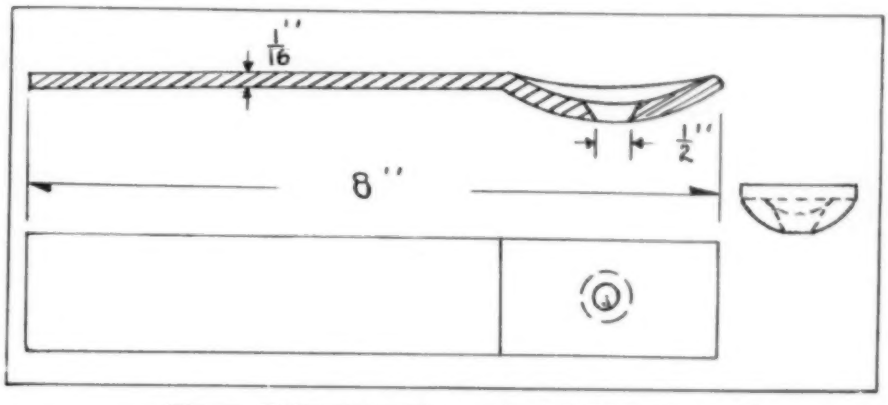


FIG. 11—HOME MADE TOOL FOR ROUGHING OFF WOOD

Publish Transactions

Transactions A. F. A. Vol. 32, parts I and II, American Foundrymen's association, Chicago, 1925, illustrations, diagrams, tables, 6 x 9 inches, cloth. Part I, 789 pages, $6.00. Part II. 387 pages, $4.00. Sections of part I; Apprenticeship, 38 pages, $0.50; nonferrous Foundry Practice, 254 pages, $2.00; Iron Foundry Practice, 173 pages, $1.00; Malleable Cast Iron, 68 pages, $1.00; Steel Casting Practice, 103 pages, $1.00.

The extent of material presented at the Milwaukee meeting, has made it necessary to publish the bound volume of proceedings of the American Foundrymen's association for 1924 in two parts. Part I contains all papers and reports other than those on sand problems. It is composed of sections on apprentice training, nonferrous castings, iron castings, steel and malleable castings; metallurgical and shop topics are included in each of these sections.

Part II is devoted exclusively to the papers and reports on sand research presented at the Milwaukee meetings, and in addition contains the report of the joint committee on geological surveys, covering the foundry sand resources of ten states. The geological survey departments of these states co-operated with the committee by making the surveys and obtaining samples of the sands. The testing of the samples, numbering more than 700, was carried on at the bureau of standards, Cornell university and the University of Illinois.

As all the sands were tested under uniform conditions and by methods specified by the standards issued by the joint committee on molding sand research, all these sands can be compared as to their various physical properties.

Testing Society To Meet

The twenty-eighth annual meeting of the American Society for Testing Materials will be held at the Chalfonte-Haddon Hall hotel, Atlantic City, N. J., during the week of June 22. Registration opens Monday morning, with committee meetings to follow the remainder of that day and Tuesday.

Ten technical sessions have been arranged, covering wrought iron, cast iron, nonferrous metals, corrosion, steel and fatigue of metals, research, testing and specifications as well as paints, textiles, ceramics and building materials.

Molds Emergency Worm Wheel

Necessity for Delivering a Casting at the Earliest Possible Moment Was Responsible for Casting the Wheel in Green Sand From Limited Pattern Equipment

By James Edgar

TIME and expense are involved in the production of a worm wheel pattern. A loam or dry sand mold has to be dried, therefore in an emergency it is not uncommon to risk a casting in a green sand mold. With care and skill and a minimum amount of pattern equipment a satisfactory casting may be produced. With the green sand method the mold is made practically in the same manner as if a full pattern is employed. The greater part of the mold is made in the floor and is covered by a cope that is located in place by suitable stakes at the corners. A sectional view of the wheel is shown in Fig. 1 and the two sweeps required to form the mold are shown in Figs. 2 and 3.

The sweep usually is chamfered so that the cutting edge is in front when the sweep is revolved in a clock-wise direction. This arrangement is not arbitrary, many sweeps are chamfered to cut the other way, but the left-to-right movement usually is favored. The sweep arm usually is offset as shown in Fig. 4 so that the cutting edge of the sweep will be on a true radial line. Additional pattern equipment required includes a tooth block Fig. 6, a spacing ring Fig. 7, six ribs not shown and a corebox Fig. 9.

A duplicate of the upper side of the wheel is swept on the foundry floor with the sweep Fig. 2. It will be noted that the sweep follows the contour of the upper face of the teeth and then extends horizontally for a short distance to form a joint line. Inside the teeth the lower edge of the sweep corresponds to the upper face of the web connecting the hub with the rim. The inner part of the sweep forms a duplicate of the wheel hub. The loose ribs *C* Fig. 1 are adjusted in place and after the entire sand face has been sprinkled with parting sand, a core is set on, rammed full of sand, lifted off and finished. A quantity of sand corresponding to the size and shape of the wheel is dug out of the floor and the sweep Fig. 3 is attached to the spindle to form the correct shape of the mold. Instead of bedding a set of ribs into a mound of green sand under the web, it is more convenient to form that part of the mold with a set of dry sand cores made from the corebox Fig. 9. In fact if the design of the wheel permitted an opening in the web between each pair of arms one of the dry sand cores might be superimposed on the other to fill the entire space between each pair of arms. Even with a continuous web the upper core might be supported on chaplets to serve the same purpose.

The six extra cores involve a certain amount of work, but it is doubtful if the wheel costs any more than the wheel made with half green and half dry sand. Measure against the time required to make the six ribs, adjust them in place and then adjust the cores in the lower half of the mold to correspond, the all-dry sand core for the ribs and web probably is more economical. Certainly it is more likely to be accurate in bringing the upper and lower ribs into line with each other.

The teeth are formed on the rim, one at a time until the circle is

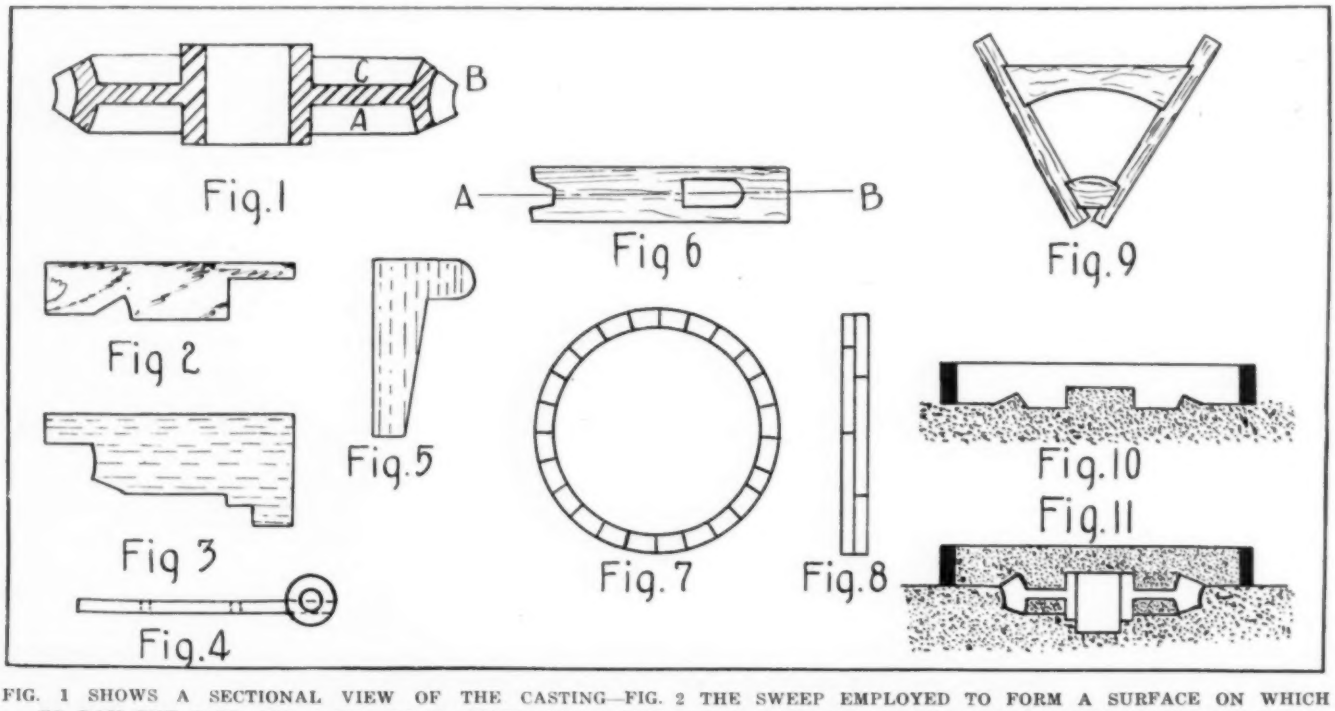


FIG. 1 SHOWS A SECTIONAL VIEW OF THE CASTING—FIG. 2 THE SWEEP EMPLOYED TO FORM A SURFACE ON WHICH TO RAM THE COPE—FIG. 3 THE DRAG SWEEP—FIG. 4 THE SWEEP ARM—FIG. 5—THE WEDGE FOR HOLDING THE TOOTH BLOCK—FIG. 6 IN PLACE ON THE SPINDLE—FIGS. 7 AND 8—THE SPACING RING—FIG. 9 THE ARM COREBOX—FIG. 10 COPE RESTING ON PREPARED JOINT—FIG. 11 SECTION OF FINISHED MOLD

complete, before the cores are placed in the lower part of the mold. Instead of the usual round hole for the spindle, the tooth block Fig. 6 is provided with an oblong opening so that the tooth may be withdrawn horizontally after each tooth is formed instead of vertically as in spur gear molding practice. The half round end of the opening fits closely against the spindle and the wedge Fig. 5 is dropped in the front part of the opening to prevent the tooth block from receding when the sand is packed against the tooth.

Teeth on full worm wheel patterns usually are formed individually and afterward attached to a prepared face on the rim of the pattern. In the instance illustrated only one tooth is required and readily may be cut from the solid end of the tooth block. The block is jointed along a center line *A B* Fig. 6 and with this arrangement the slot for the spindle and the space for the sand tooth readily may be roughed out on the band saw from the end of the tooth block.

A spacing ring of some kind attached to the lower face of the mold is required to insure accuracy in setting the tooth block for each tooth. A ring similar to that shown in Fig. 7 answers the purpose. It is arranged on the bottom of the mold so that the tooth block rests directly on it when in proper position for forming the teeth. A circle is scribed on the ring and radial lines are drawn from the center to represent each tooth. A hole is bored at the point where each radial line intersects the circle and a removable dowel pin at a corresponding point on the tooth block guides the block accurately into position for each tooth.

No mention is made of a corebox for the center core, because every foundry in which a job of this kind would be attempted, is supplied with an array of coreboxes from which a suitable selection could be made. On small wheels it might be preferable to use a small wood hub for a pattern, but on the larger sizes the hub as well as other parts of the mold, is formed easily with the sweep.

Top Pouring Produces Better Castings

BY J. L. SENDNER

THE theory regarding the draining of the eutectic portion of the metal downward after crystallization and the consequent minute crevices or intercrystalline cavities left in the drained portion of the metal, is logical and can be substantiated by the careful inspection of sound and leaky brass castings.

This drainage, or setting of the eutectic, is particularly noticeable when a light bushing is connected to an extremely heavy flange. In an exaggerated case of this description considerable difficulty was experienced in obtaining sound castings. The light bushing end passed the hydrostatic test after the casting was machined, while the heavy flange end leaked under pressure. It was found necessary to chill this heavy part, in addition to the large risers provided, before sound castings could be produced.

The drainage of the eutectic, or which might be called intercrystalline shrinkage, should not be confused with the regular metal shrinkage. The former takes place after the crystallization period. Metal shrinkage in the general sense of the word is the shrinkage that occurs during the period of crystallization.

In the manufacture of tube sheets, rolled material is usually specified. However, due to lack of such material, it is quite often found necessary to resort to cast metal. In this event trouble may be anticipated as there are but few jobs of plain appearance that cause as much grief among foundrymen. It has been our experience, during the past 20 years, to cast at various times tube sheets ranging in size from 12 inches to 3½ feet long by 9 feet in diameter with varying success. Well made molds, properly vented and dried, produced castings of excellent appearance which passed the preliminary hydrostatic test only to fail when retested after the tube holes were drilled and tapped. Invariably the defect appeared in the center of the casting approximately midway between the plane surfaces. These castings were molded horizontally and poured in an inclined position with gates at the lower and risers at the upper end. A riser placed at the center of the casting proved beneficial in stopping the ordinary shrinkage but was not a guarantee of good castings. It has been our practice of late years when making tube sheets, if not too large in diameter, to mold them horizontally in an iron flask using two cast iron bottom plates and casting the mold in a vertical position with gates and risers at the top of casting. This method has proved satisfactory. When cast in a horizontal position the center remained hot after the rest of the casting had passed the crystallization period and the eutectic portion, drained from the center, gravitated toward and filled the interstices among the metal crystals. This action was assisted by the pressure of the fluid metal in the riser until a thin shell had formed around and immediately under it, cutting off the supply of eutectic before the center of the casting had entirely solidified, thus leaving an intercrystalline shrinkage as described by Vickers.

The following is offered in reference to the production of large bushings. Some foundries on the Pacific coast mold and pour their large brass bushings horizontally with gates placed on top longitudinally. One foundry in particular employs this method successfully, although considerable of its success is due, no doubt, to the fact that it uses properly made loam cores.

On pages 231 and 232 of THE FOUNDRY of June, 1915, in an article entitled "Top Pouring Brass Liners," the writer describes with illustrations the vertical method of molding and pouring large bushings and liners with pop gates. This method has proved so successful for work of this character that it has been made standard practice at the Puget Sound navy yard foundries. Here propeller shaft sleeves, shaft bearings and pump liners from 10 to 30 inches in diameter, and from 2 to 10 feet in length are made regularly. Usually these castings are required for ships in drydock, and the time element is of great importance, therefore, the method used must of necessity be a sound and safe one. An order for 10 shaft sleeves and bearings 18 inches inside diameter, 21 inches outside diameter, and from 5½ to 8½ feet long recently were made by this method, and the castings produced were of a high grade. No claim is made for originality as the writer adopted this procedure from the regular custom of pouring and molding cast iron marine cylinder liners. Old timers and modern foundrymen would not consider pouring large liners of cast iron any other way, and as a dry-sand mold withstands the action of hot iron and semisteel little danger is encountered from bronze at a much lower temperature. The equipment is

The author, J. L. Sendner, is master molder, United States navy yard, Puget Sound.

simple, sectional iron flasks are used and dried in the oven, cores are swept in halves from a skeleton corebox the same as if molded horizontally. However, the core vent all should be led off at the top and the mold should be thoroughly dry. The only defective large bushings or liners of brass made here in the past several years were defective owing to the following two causes: first, molds that were not thoroughly dry and, second, an attempt to lead the core gas off at the bottom owing to the difficulty encountered in negotiating a heavy cross placed in the top part of the core.

Again referring to the eutectic drainage, it is believed that this feature is better taken care of in a top poured casting for the following reasons: the hottest metal is always on top, which provides ideal feeding conditions; the incoming metal has an agitating or churning effect which is also a good feature in producing sound castings. Four to six inches of additional metal is added to the desired length of bushing. This acts as a reservoir for feeding the casting properly.

Adopts Pattern Plan for Turbine Casting

(*Concluded from Page* 435)

wall of the pit was rammed at the same tme. A parting was made at the sides and the lifting plates for the drawbacks were adjusted and sand was rammed up to the predetermined parting line for the cope.

The cope was rammed in the usual manner and removed, followed by the two drawbacks. The upper half of the pattern then was lifted out, after which the body of sand forming the false core was dug out. After the lower half of the pattern was drawn and the face of the mold finished, the various parts of the mold were skin dried and the cores were set in. The lower half of each core was placed on chaplets and jammed against the end of the mold to insure a clear vent. The upper half then was lowered into place, followed by the drawbacks and the cope. The upper half of the core was held down by chaplets.

Help Educate the Purchasing Agent

TO THE EDITORS:

The series of articles recently dedicated to purchasing agents in general no doubt has elicited considerable thought and consideration, since many of the instances recorded in these articles contain a great deal of truth. I have had to face some of the identical problems as A Victim.

I thoroughly believe that a great amount of selling and buying of general foundry castings at low prices is due to ignorance of foundry operations. In other words, ignorance in regard to costs and a total indifference in respect to small details, which always are considered cost items but seldom figured, prevails in most foundries. The additional cost of unloading coke, scrap and pig iron is not figured by some foundries while the cost for trucking, shipping, crating, boxing and for barrels often is neglected. These features are direct costs against the products turned out by the foundry, and in conjunction with many other items must be taken into account.

In North Carolina, where the demand for castings made in quantities on a production basis practically is unknown, the operating cost to produce light, quality castings most generally used is proportionally high. In my opinion, too many foundry operators want to keep a full force of molders when they are physically unable to do so, facing lack of orders. To maintain a force of men when competition is keen, as usually is the case, results in price slashing without regard to costs.

I have known small machine castings weighing less than one pound each to sell at less than 4 cents a pound from a small jobbing foundry, which must be below cost. A buyer of a fair tonnage of gray iron castings recently advised me that a foundry salesman told him confidentially that his foundry had developed a secret process for making gray iron castings. I believe that the price for the castings was about 5 cents per pound, with no charge for making patterns. When I looked at the castings it appeared that the secret had been consumed in the fiery depth of the cupola. Secrecy in regard to the manufacture of gray iron castings cannot stimulate sales, nor does the cutting of prices and advising the purchasing agent that you can produce a casting equally as good as your competitor.

If we cannot make castings better than our competitor, our policy has been to keep striving to increase that quality until there is a basis for argument.

The purchasing agent usually is composed of the same ingredients as the average foundryman, although he may wear horned rimmed spectacles and patent leather shoes whereas the foundryman, in which category we are included, is fortunate indeed to provide himself with a pair of old brogues. The purchasing agent must take his job seriously since there probably are six or more department heads watching him, either favorably or unfavorably, according to his discretion in buying.

I have found that truth regarding quality and price backed by a standard product and rigid inspection in the shipping department, plus good judgment in foundry operations and deliveries commensurate with promises, will go a long way toward establishing respect from the purchasing agent's side.

Let us foundrymen take part of the blame and educate ourselves and our good friend the purchasing agent to the vital need of high quality castings and a price in keeping with this quality.

Prices must be maintained to keep red ink off our ledgers.

E. R. MCCUISTON
Manager and Superintendent.

Briggs-Shaffner Co.,
Winston-Salem, N. C.

Milestones in Foundry Progress

As Recorded in the June Issues of THE FOUNDRY, Thirty, Twenty and Ten Years Ago

1895

SPLENDID recognition of the lives and work of Lazard Kahn, J. W. Van Cleave, Julius Goldschmidt, W. S. Stevenson, Henry Cribben, A. C. Mott and other officers of the national organizations of stove manufacturers occupied a great part of THE FOUNDRY of June, 1895.

* * *

Rising prices were the order of the day. Bessemer pig iron was up 26 per cent, and foundry iron 15 per cent, while wages were advancing. The foundrymen were advised that their prices should be pushed up. The old questions of uncertain costs and the willingness to believe the other fellow's statements about competitive prices were blamed for the low return in the foundry business.

* * *

Krank's Korner was filled with comment on the false economy of using cheap and inferior molding sand. The foundryman who favored a home sand, through local patriotism, was branded as one who flirted with bankruptcy. The real attraction, said Krank, was the low freight rate obtained from the wagon and mule team delivery.

* * *

Demonsthenes, the famous Greek, at one time said to have been traveling for a foundry supply house, was seen one day by a salesman of the Athens Molding Sand Co., a rival firm, prospecting about the gravel pits of the latter company. On being asked what was his mission, the young orator hurriedly thrust a handful of sand, which he was holding, into his mouth and with rare presence of mind mumbled an unintelligible response. Thus, it is said, originated the expression, PERMEABILITY TEST.

* * *

The Malleable Iron Fittings Co., Branford, Conn., placed a contract for a new foundry building.

* * *

Leland & Faulkner Mfg. Co., Detroit, from which was to come the present Cadillac Motor Car Co. foundry ordered complete equipment, including cranes, cupola, ladles and supplies from a Detroit equipment firm.

Faked Foundry Facts

Tumbling Barrels

This foundry was the training school for many foundrymen who later were outstanding figures in the development of the automobile cylinder production.

* * *

Officers of the Western Foundrymen's association, whose pictures and biographies were given included, John M. Sweeny, president, A. W. McArthur, vice president, S. T. Johnston, secretary and O. T. Stantial, treasurer.

* * *

*S. T. Johnson is the name of the good looking secretary * * * When asked for a few lines concerning his eventful career, he replied that he had none—only knew from hearsay that he was born in Glasgow, Scotland, said the comment in the June, 1895, issue.*

* * *

James Chalmers, using every chance to bum a ride to get out of Texas, worked on a Frisco pile driver for a few days and then headed for Springfield, Mo.

* * *

The Plumbago club, meeting in Chicago, was presented with a six-pound gavel, by H. S. Vrooman of the Garden City Sand Co.

* * *

The club must have expected some heavy banquet speakers. Remember the souse who remarked, "Hit me 'gain, can shtill hear 'im."

1905

THE recently completed foundry of the Oil Well Supply Co., Oil City, Pa., was described in the June, 1905, issue of THE FOUNDRY. Women coremakers are shown in a view of the malleable department coreroom.

* * *

The name of the Diamond Drill & Machine Co., Birdsboro, Pa., was changed to the Birdsboro Steel Foundry & Machine Co.

* * *

No. 2 southern iron was selling at $13, furnace, while northern iron was bringing $15.50 a ton.

* * *

* * *

Dr. Edward Kirk in a general article on training men in foundry work devoted much space to the drinking habit.

* * *

The writer referred to a kettle of beer. Always heard such a vessel called a pail or growler. Important scientific point is raised.

1915

UNCLE SAM'S repair ship, the VESTAL, equipped with a foundry capable of making castings for 21 battleships was described in the June, 1915 issue of THE FOUNDRY. F. M. Perkins was the author.

* * *

G. S. Evans presented an exceptionally interesting discussion on the effect of annealing light gray iron castings. He reported that small castings rejected by the machine shop as too hard could be reclaimed at a cost of $2 a ton.

* * *

More cupolas were in operation than at any time during the year, according to the trade outlook report. No. 2 foundry iron was selling for $13.45 a ton, Pittsburgh.

The Shakeout

DAN M. AVEY, Managing Editor
PAT DWYER, Engineering Editor
CHARLES VICKERS, Nonferrous Editor
FRANK G. STEINEBACH, Associate Editor

¶ Protect Poor Dumb Motorists

THE City of New York recently decided against the use of all cast iron posts, stating that when such a post is struck by a vehicle and broken, parts of the post will fall to the street with possible injury to persons or property. At any rate, that is the reason given for deciding against the cast type of post. The thought suggests itself that the American Society for the Prevention of Cruelty to Animals, with headquarters in that city, might perhaps have found it desirable to extend its protection to that increasing class of automobile drivers which may be classified, without dissent, as dumb. Fulfilling the law of compensation, would it not be reasonable to assume that the society, no longer needed by horses, may have spread its mantle of friendly help over the dapless motorist.

OF COURSE, no one would suggest that those interested in the sale of competing posts, such as the concrete or rolled products, ever inspired such a thought. They would have been much more concerned with elements of attractiveness, service, price and delivery of their own products and would have avoided the gruesome thought of accident and sudden death by missiles flung from exploding cast iron lamp posts. It would be interesting to know just where this thought *did* originate and to have some casuality statistics on this form of street accident.

¶ Who Has Lucky Numbers?

WHEN Mr. Hoover's committee on standardization and elimination of waste finally arrived at the foundry, the members individually and collectively will earn the gratitude of foundrymen in general, if they induce the manufacturers of cupolas and cupola blowers to adopt a uniform system for numbering their products. Fortunately, in the ordinary course of events this point will not be reached for many years and the manufacturers of these pieces of foundry equipment cannot claim they were hurried unduly into making a change. The foundry always is the last place to receive attention in the average plant.

Every manufacturer has a system of his own and since it is an arbitrary system based on no common unit, the number by which each cupola or blower is designated conveys no tangible message to the mind of the man who sees it. The numbers might, and probably do, serve admirably in the fabricator's plant to keep track of the product, but they are practically of no value after the furnace or fan has been set up in the foundry.

THE plea might be advanced that the foundryman at some time might need a repair part. The work of ordering the part would be facilitated greatly by ordering for example, one front left leg for No. 6 cupola, or one driving pulley for No. 7 blower. No statistics are available on the subject, but so far as we can learn no repair parts ever were ordered by any foundryman either for his cupola or his fan. True, none of these pieces of equipment has been in use 100 years and it may be that the second century may show them up.

In the meantime the maker's name and the number only have an advertising value and they would serve their purpose much more admirably if the number meant something definite. At present No. 1 cupola made by one company has a rated melting capacity of 1 ton per hour. No. 1 cupola made by a second firm is guaranteed to melt 25 tons per hours.

Some spread!

¶ Nobody Wants the Job

PERIODICALLY the question of the dwindling supply of skilled molders pushes insistently to the front. As long ago as 1895 writers in THE FOUNDRY predicted that the man who could handle the difficult phases of foundry work fast was making his exit and soon the stage would be vacant. Foundry owners were urged to encourage young men to enter their shops.

APPRENTICE training forms the subject of discussion in group meetings, it is a matter of deep thought among individual employers whose work depends upon a supply of skilled molders. In a recent address, Magnus W. Alexander, president of the National Industrial Conference board states, "Not only has the supply of common labor been shortened, but industry must seek far and wide for skilled labor. Industry must draw its supply of skilled and highly specialized workers from within." This really is the essence of the whole problem. The public educates children in a rudimentary way. The colleges are available for those who specialize in the professions. But the initiative, the inspiration and the driving force necessary to provide systematic training for foundry workers must come from foundrymen and foundry organizations.

Trade Outlook in the Foundry Industry

SLOWLY, but surely, the spread between production and consumption is being eliminated in practically all lines. With the universal tendency to avoid stocking materials either for use or sale, and with the continued high rate of turnover, the balance between rate of manufacture and distribution is being approached. No better evidence is to be found of the tremendous total volume of business being transacted than is furnished by the movement of freight. The record week of the year for number of cars loaded, according to the American Railway association was that ending May 2, while the total for the first quarter of the year was well above the same period for 1923 and 1924.

What Is the Measure?

Practically any foundryman if asked in general about conditions, will complain of the present period. However, if he is pinned down to a comparison with last year's business or in many cases with that of the year before, he will confess that these times might be worse. One manufacturer stated the case when he said that business is good, but not as good as had been hoped for. His company made well above 15 per cent on its capital investment during the post war prosperity and finds it difficult to accept 8 per cent return under the conditions obtaining at present. Bank clearings are heavy. Sales both of mail order houses and chain stores are large and growing. Employment in manufacturing industries has been increasing slowly and steadily since the first of the year, but the aggregate earnings have declined, according to the department of labor. The iron and steel industry is particularly well placed in employment figures, as are also the automotive manufacturing plants, and agricultural implement firms.

Prices for Raw Materials for Foundry Use

CORRECTED TO MAY 22

Iron		Scrap	
No. 2 foundry, Valley	$18.50 to 19.00	Heavy melting steel, Valley	$17.25 to 17.50
No. 2 southern, Birmingham	18.00 to 21.00	Heavy melting steel, Pitts.	16.50 to 17.00
No. 2 foundry, Chicago	21.00	Heavy melting steel, Chicago	14.75 to 15.25
No. 2 foundry, Philadelphia	21.76 to 22.26	Stove plate, Chicago	14.75 to 15.25
No. 2 foundry, Buffalo	19.00	No. 1 cast, Chicago	19.25 to 19.75
Basic, Valley	18.50 to 19.00	No. 1 cast, Philadelphia	17.50 to 18.00
Basic, Buffalo	19.00	No. 1 cast, Birmingham	16.50 to 17.00
Malleable Chicago	21.00	No. 1 cast, Buffalo	15.50 to 16.00
Malleable, Buffalo	19.00	Car wheels, iron, Pittsburgh	17.00 to 17.50
		Car wheels, iron, Chicago	16.00 to 16.50
		Railroad, mal., Chicago	17.50 to 18.00
		Agricultural, mal., Chicago	16.50 to 17.00
		Malleable, Buffalo	17.50 to 18.00
Coke			
Connellsville foundry, coke	$3.65 to 4.25		
Wise County foundry, coke	4.50 to 5.25		

Rail Prospect Brighter

Inquiry for increasing numbers of railway cars is a bright spot in the future of the foundry industry. Over 15,000 cars are in immediate prospect in Chicago while recent orders have been placed for rolling stock totaling almost this amount. It is stated that the total of railway car inquiries under consideration will range above 50,000 cars. The number of unfilled orders for locomotives has been mounting since the first of February, according to the department of commerce. Steel mills again are increasing production, the daily average bookings of the United States Steel Corp. having exceeded those for April. Roll foundry operations are spotty. One Pennsylvania roll maker has been operating at capacity for the past month on orders for shipment abroad. Others are only fairly busy. Steel mills are not ordering rolls so far in advance of their immediate requirements, and obviously foundries cannot stock these castings which vary so far from standard as to constitute practically specialty work.

No Sectional Division

A peculiarity of present foundry operations is the fact that variation does not follow geographical divisions. It is impossible to state that the East is busy and the middle western section slack, or to reverse these statements. In the vicinity of New York jobbing foundries are operating at about 50 per cent of capacity. In northern New Jersey, one gas stove manufacturer is working day and night shifts and similarly a nearby stove and boiler plant is exceedingly busy. In the Cleveland district stove foundries are not above 50 per cent. The automobile foundries present a similar situation. One shop in Cleveland is working at about 50 per cent of capacity, while another lags behind this figure. Those foundries which are operated as departments of large automobile plants follow closely the fortunes of the sales departments of their individual establishments. The low and medium price passenger car shops are working at capacity, with but few exceptions. Operations among the Ohio foundries according to the Ohio State Foundrymen's association dropped a fraction of one per cent to an average rate of 74 per cent in April. During the same month last year the rate was 74.6 per cent. Stocks received declined to 54 per cent in April, compared with 64 per cent in March, while stocks on hand showed a slight loss. A buying movement is at hand in pig iron with a growing volume of business booked by furnace interests in Chicago, Philadelphia, Cincinnati and in New England. Inquiries for both foundry and malleable grades are active.

Nonferrous Operations

Brass foundry operations are spotty. Those shops making automobile castings are busy and are buying more metals. Nonferrous foundry operations stood at 58 per cent of capacity during April in Ohio. New York prices on nonferrous metals, according to the *Daily Metal Trade* of May 21 were as follows: Casting copper, 13.05c to 13.10c; electrolytic copper, 13.62½c; lead, 8.00c; Straits tin, 54.75c; antimony, 16.50c; nickel, 38.00c; No. 12 remelt aluminum, 22.50c. Zinc was 6.90c, E. St. Louis, Ill.

Comings and Goings of Foundrymen

WILLIAM J. CORBETT, recently appointed secretary-manager of the Steel Founders' Society of America, with headquarters at Pittsburgh, has had a wide and varied experience in the foundry industry. He received his preliminary education in Erie, Pa., and in 1914 received the degree of bachelor of science in mining engineering from the Carnegie Institute of Technology and later the degree of metallurgical engineer from the same institute. After graduation, Mr. Corbett became a special apprentice at the Alliance works and later at the Chester works of the American Steel Foundries, where he finally held the position of production engineer. In 1917 he received a commission in the army and was army inspector of ordnance, Buffalo. In January, 1918, he was transferred to Watertown arsenal as assistant superintendent of the foundry in charge of the manufacture of castings. After leaving the army, he became assistant to fourth vice president of the American Steel Foundries with headquarters in Chicago. In 1921 Mr. Corbett became cost accountant with the Steel Founders' Society of America, which was promoting the use of uniform cost finding methods in the steel foundry industry. In 1923 he became industrial engineer for the Electric Steel Founders' Research group, which is composed of five steel foundries conducting co-operative research work.

J. W. Hargate, for many years connected with the Scullin Steel Co., St. Louis, has been appointed general purchasing agent of the National Enameling & Stamping Co., with office in Granite City, Ill. The appointment was effective May 1. Mr. Hargate for five years had been in charge of the purchasing department of the Scullin Steel Co.

Frederick M. Becket, vice president of the Electro Metallurgical Co., New York has been elected president of the American Electrochemical society as was announced at the Niagara Falls meeting. Mr. Becket is one of the charter members of the society and has always taken a keen interest in its affairs. He has been on the board of directors for a number of years, recently serving as a manager. In 1923 Mr. Becket was proposed as the society's candidate for the Perkin Medal, and in acknowledgment of his noteworthy achievements in electrochemical and electrometallurgical fields, the medal was awarded to him in February, 1924.

H. W. Gillett has been chosen vice chairman of the electrothermic division of the American Electrochemical society.

Erik Bergendal, mechanical engineer, Husqvarna Vapenfabriks, A. B., Huskvarna, Sweden, is engaged in an inspection tour of the leading foundry centers of America where he will study castings manufacturing and factory management problems.

WILLIAM J. CORBETT

H. W. Brown, secretary and sales manager for the Tabor Mfg. Co. of Philadelphia, one of the largest producers of foundry molding machines and equipment, is making an extensive survey of conditions on the Pacific coast and expects to spend three months there before returning East.

Carl Alhgren has been appointed foreman of the Chandler Heater Co., Cedar Rapids, Ia. Mr. Ahlgren has been employed by the company for a number of years.

Sir Gordon Ley, chairman, and George E. Allin, works manager, Ley's Malleable Castings Co., Ltd., Derby, England, are spending several weeks in the United States studying methods of producing malleable castings. According to Mr. Allin, European producers of malleable iron are greatly interested in the progress which has been made in this country in the application of pulverized coal for melting and annealing.

Dr. Richard Moldenke addressed the Pittsburgh Foundrymen's association at its regular monthly meeting, May 18, at the General hotel. His theme was "Recent Foundry Progress."

T. E. McFall recently has been elected vice president and superintendent of the Connor Foundry Co., Grand Rapids, Mich. For several years Mr. McFall was supervisor at Campbell, Wyant & Cannon, Muskegon, Mich., and was foundry superintendent of the Piston Ring Co., Muskegon, Mich., for four years.

M. B. Gilberson Sr. now is president and manager of the new Chelsea Foundry Co., Chelsea, Mich.

F. M. Flander, formerly superintendent of the Independent Stove Works, Owosso, Mich., has started a foundry in that city to manufacture brass, bronze and aluminum castings. Mr. Flander also was connected with the Standard Machine Co., Owosso.

To Sell Supplies

The Pennsylvania Foundry Supply Co., Liberty building, Philadelphia, has been incorporated with a capitalization of $100,000 to take over a manufacturing plant and open branch warehouses. The officers of the company are S. B. Wentz, president, and H. E. Mandel, secretary and treasurer. Mr. Mandel will have charge of the selling organization and a branch warehouse will be established at York, Pa., under the supervision of Millard F. Carr who has been in the foundry supply business for the past 30 years.

The property of the Baltimore Valve Co., Baltimore, Md., has been acquired by new interests and will be operated under the name of the Baltimore Valve Corp. The officers of the new organization are: W. Fairfield Peterson, president; Julian H. Marshall, vice president and treasurer; W. F. Brune, secretary; E. F. A. Morgan, assistant treasurer.

Cleveland Foundryman Is Killed

William Folger Swift, secretary-treasurer and general manager of the City Foundry Co., Cleveland, was asphyxiated in his garage by exhaust gas from his automobile, May 17.

Mr. Swift was born in Cleveland, 1885. He was educated in Cleveland, was graduated from the Central High school in 1903 and from the Case School of Applied Science in 1907, specializing in mechanical engineering.

After leaving college Mr. Swift went west and entered the employ of

WILLIAM FOLGER SWIFT

the Colorado Steel & Iron Co., Pueblo, Colo. He returned to Cleveland during the same year and became associated with his uncle. W. D. Sayle, owner of the City Foundry Co. and was constantly with that company up to the time of his death, covering a period of 17 years during which time he was responsible for many scientific improvements in the foundry.

Mr. Swift was a member of the American Society of Mechanical Engineers and the American Foundrymen's association. He is survived by his wife, Viola Henn and three young children.

Traces Cannon Making

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obscurity, it has been computed that a projectile would probably have about 5200 feet per second velocity and would carry a projectile of 264 pounds a distance of 76 miles.

The elevation of the gun for this fire was probably about 54 degrees and the projectile mounted to a maximum height of about 24 miles in traversing the trajectory of 90 miles between the gun located in the Forest of St. Gobain near Laon, and Paris.

The great range was obtained, no doubt, because the projectile traveled in lighter strata, which would offer less resistance to its flight, and because a comparatively small projectile was used with a large powder charge in the chamber made for heavier projectiles.

George Smart Dies

George Smart, for the past eight years one of the directing editors of the *Iron Age* and for 12 years previout to that time editor of *Iron Trade Review*, died suddenly at his home in Forest Hills, L. I., May 16. His age was 62. Mr. Smart was born in Chillicothe, O., Nov. 11, 1863. He was graduated from Ohio State university and first engaged in the work of a reporter in Columbus. Subsequently, he joined the staff of the *Cleveland Plain Dealer* and served progressively as reporter, editorial writer and Washington correspondent. In 1898 he became legislative reporter at Columbus for the *Cincinnati Enquirer*. Shortly after, in association with others, he founded the *Columbus Citizen* and was the editor of that publication from 1899 to 1902. In the latter year he joined the *Iron Trade Review* as associate editor. His elevation to the editorship followed three years later and he filled with distinction this post for 12 years until in 1917 when he resigned to be associated with A. I. Findley and W. W. Macon in the management of the *Iron Age*.

Apart from his work as an editor, Mr. Smart achieved high honors in the various avenues of his activities. He served as national president of the Phi Kappa Psi collegiate fraternity, as president of the Ohio State University Alumni association and was prominent in the affairs of the National Conference of Business Paper Editors and in the New York Editorial Conference.

Private funeral services were held at Forest Hills, May 18. A special memorial service is to be conducted, Sunday, May 24, at the Church in the Gardens in Forest Hills.

H. P. Rodgers, 508 Leader-News Bldg., Cleveland, has been appointed district representative in the Cleveland territory for the Pennsylvania Pump and Air Compressor Co. of Easton, Pa.

Veteran Sand Man Dies at Cleveland Home

William H. Smith died May 13, at his home in Cleveland at the age of 71 years. He was born in Cleveland in 1854 and received his education in the public schools of the city and Mount Union college, Alliance, O. At the age of 22, shortly after leaving college he entered his father's business in the preparation of glue and curled hair. The family at this time owned extensive property west of the city of Cleveland. The land contained large sand deposits and Mr. Smith, realizing its suitability for molding

WILLIAM H. SMITH

purposes, built up a business supplying the foundries around Cleveland.

During the interval from 1895 to 1924 Mr. Smith made the sand business his sole occupation until he retired in 1924 as vice-president and general manager of the Superior Sand Co. However, he retained directorship in that company up to the time of his death. He and Uncle Billy Chambers were considered the two oldest sand men in the country.

Mr. Smith was a life and honorary member of the Molding Sand association and held directorships in the Werner G. Smith Co., Cleveland and the Cleveland Cartage Co. He is survived by his wife, Mary C., four daughters, and one son, Werner G. Smith, president of the Werner G. Smith Co., Cleveland.

The directors of the Thatcher Furnace Co. have changed its name to the Thatcher Co. The headquarters of the company are in Newark, N. J.

Plan Syracuse Meeting

Fourteen technical sessions have been planned for the 1925 Syracuse meeting of the American Foundrymen's association, which will be held the week of Oct. 5 to 9. This number of sessions has been made necessary because of the increasing divisions of foundry work which are being given attention by investigators and writers. Also, the program committee has attempted to arrange the meetings so that those who plan to stay only a couple of days may choose a time when technical sessions in which they are most interested are grouped. This grouping of the meetings now provides for steel and nonferrous sessions the first two days of the convention, general meetings of interest to all fonurdymen on the second and third days, and malleable iron and cast iron on the fourth and fifth days. Because of the extent of interest in the cast iron field, a general session on this subject also will be held the first day of the convention to provide a discussion session for those who cannot be present during the latter part of the week. The schedule of the meetings is as follows:

Monday, Oct. 5

AFTERNOON

1. Joint opening session on nonferrous metals.
2. Gray iron foundry practice.

Tuesday, Oct. 6

MORNING

3. Steel foundry practice.
4. Aluminum alloys

LUNCHEON ROUND TABLE DISCUSSION

5. Brass Foundry Topics.

AFTERNOON

6. Apprentice training.
7. Refractories.

Wednesday, Oct. 7

MORNING

8. Steel foundry metallurgy.
9. General committee reports.

AFTERNOON

10. Business session.
11. Sand control and research.

Thursday, Oct. 9

MORNING

12. Malleable cast iron.
13. Metallurgy of cast iron.

AFTERNOON

14. Sand control.

Friday, Oct. 9

MORNING

15. Gray iron foundry practice.

On Tuesday, Oct. 6, a luncheon will be held for those interested in brass foundry shop problems. After the luncheon an informal discussion on practical shop problems will be held. This meeting is especially for shop foremen and each will be given a chance to contribute to the discussions. No report of the discussions will be kept, as it is desired to have all feel especially free to express his views.

Apprentice training again will be taken up at an open meeting at which time methods of carrying on training in the smaller plants and unorganized groups will be explained. The committee desires to give the greatest publicity to apprentice training, as it is felt that it is one of the greatest needs of the foundry industry at the present time.

Steel and malleable iron will be discussed at the usual sessions.

British Pay Tribute to A. O. Backert

News of the sudden and unexpected death of A. O. Backert, president of the Penton Publishing Co. and editor of The Foundry, was received with great regret in Great Britain where on the occasion of his visit some years ago he made many friends. His great services in the promotion of fraternal relations between British and American foundrymen were greatly appreciated by the leaders of British foundrymen. He was regarded with personal admiration by all and by his most intimate friends with affection. The opportunity was taken at the annual meeting of the Birmingham and West Midlands branch of the Institute of British Foundrymen, held in Birmingham, April 30, to give expression to the prevailing feelings by a vote of condolence expressing the regret of the members and the deepest sympathy with the relatives and friends of Mr. Backert. The resolution was moved before a large and representative gathering by Thomas Vickers, the president of the institute, who remarked that British foundrymen had, during the past three or four years, come into intimate touch with Mr. Backert through the interest he had taken in the formation of the international relations committee and he had done much to improve the cooperation between the craftsman of the two countries. His name would be long remembered and honored by British foundrymen.

Opens Equipment Office

Frederick B. Wilmot, formerly in charge of industrial equipment sales for the Detroit Range Boiler & Steel Barrel Co. resigned May 1 to open a distributing office for industrial transportation equipment. He will represent the firm with which he previously was connected and also the Barrett Cravens Co., Detroit, in the Michigan territory. Mr. Wilmot previously was connected with the Firestone Rubber Co. and later with the Kales Stamping Co.

Improving Properties of Aluminum Alloys

At the annual general meeting of the Institute of Metals held in London, recently, S. L. Archutt a member of the institute presented a paper, entitled "A Method of Improving the Properties of Aluminum Castings." The experiments described in this paper and the result obtained from them indicate the possibilities of treating aluminum and certain of its alloys to eliminate a considerable proportion of dissolved gas and thus reduces unsoundness, and surface pinholes.

The process suggested consists in allowing the molten alloy or metal to cool slowly in the crucible in the furnace until it has just completely solidified. It then is remelted, and may be stirred, raised to the pouring temperature, and cast. Ingotting the metal is not satisfactory, as the ingots cool too quickly, and during remelting are too much exposed to the furnace gases.

In a later experiment described, passage of an inert gas through the melt during slow cooling and solidification has been found to improve still further the soundness of resulting sand-cast bars. Slightly anomalous results have been obtained in some cases, and it is not yet clear how far the method is of value in other alloys, whether consisting mainly of aluminum or of other metals.

Meanwhile, the author has learned that simultaneously and independently Prof. C. A. Edwards and W. E. Prytherch of Swansea, So. Wales, working on the effect of gases in copper for the British Non-Ferrous Metals Research association—have discovered a similar effect obtained by solidification the crucible in the case of pure copper.

Devise Method of Plating Chromium on Metal

A practical process of chromium plating, producing a hard metal surface is announced as perfected by Dr. Colin G. Fink, head of the division of electro-chemistry, Columbia university, and his associates, working in conjunction with the research chemists and engineers of the Chemical Treatment Co., New York.

Chromium ranks next to the diamond in hardness and for many years, scientists and engineers have endeavored to develop a satisfactory method of plating this metal on others. Chromium has been used in the past as an addition to steel to proudce an ex-

tremely hard alloy which is used in manufacturing armor plate. About 13 per cent of chromium is added to steel to produce the stainless steel.

Dr. Fink and his associates, it is said, developed a method of plating various metals with chromium to the point where it can be used for commercial purposes. The process is electrolytic. Dr. Fink who has given the name of Crodon to this new metal plate states that it will wear much longer than other plating. Either a soft gray or a brilliant polish may be obtained, and the finish is permanent, neither tarnishing nor corroding, so that it requiries no polishing, says the Chemical Treatment Co. The plating has been applied to copper, brass and steel, and it seems to have a wide range of uses in industry and in the home.

For experimental purposes, golf culbs plated with chromium have been used for a considerable period, exposed to the elements, and have shown no corrosion or tarnish. Over 15,000 copper, brass and steel articles, ranging from a few inches to 20 feet in length, have been plated for commercial use during the past three months, which shows a wide field.

Discuss Nonferrous Subjects

ALUMINUM slowly but surely is becoming one of the most important minerals of industry, according to Edward J. Rogers, C. E. Rogers Brass Foundry Co., Boston, who spoke before the May meeting of the New England Foundrymen's association, Boston, May 13. Aluminum, which occurs in nature as abundantly as any other metal, has the property of forming alloys which rival steel in strength and durability. The chief hindrance to the use of aluminum is its relatively high cost of production. However, the curve of production cost has been dropping off rapidly during the last 10 or 15 years, according to the speaker, and if the trend of the curve continues it will not be many years before it intersects the steel cost curve. Mr. Rogers described the deposits of bauxite clay in the Southern States, from which most of the aluminum used in this country is produced, and he recounted in considerable detail the method of commercial reduction of the metal. Alloy castings composed largely of aluminum are gaining rapidly in favor in the automobile and airplane fields. From the foundry end the speaker feels that much progress still is to be made. He said the aluminum alloys offer greater possibilities to the experimenter than copper, tin and lead alloys.

The subject of brass and brass alloys was covered by F. H. Cole, metallurgist, and C. F. Lundbom, general superintendent, of the Walworth Mfg. Co., Boston. After a general description of the principal copper base alloys and the melting methods at the Walworth plant, the meeting was thrown open to general discussion in which many members took part. One of the points brought out was the difficulty of making high lead alloys containing 15 to 18 per cent lead. It was suggested that the use of sulphur would aid the production of this composition greatly. On high pressure valves and fittings the addition of aluminum to a brass mixture, while frequently giving strength, usually increases porosity.

The temperature, at which brass is poured, is an exceedingly important item. One foundryman recommended 2100 degrees for red brass and suggested using a slight tilt to the mold, a large gate, which would let the metal flow first to the bottom and then up to the casting. It is frequently found advisable to have the metal flow up over a core just before it enters the casting, to reduce erosion of the casting mold. The Walworth Co. using an open flame 700 pound oil fired furnace, operates with a loss between three and three and one half per cent. The Walworth nonferrous foundry is a strictly production shop using exclusively molding machines of the squeezer type with most of the molding from match plates. The molders are all paid on a piece work basis and the pouring, clean up, sand and material handling gangs are paid on a tonnage basis. The turnover in the shop amounts to almost nothing. Production frequently runs to 205 to 210 molds a day per molder using 12 by 16-inch molds.

A lengthy discussion developed with reference to the use of match plates or vibrator frames. The preference was about equally divided, although many seemed to think that on general work a vibrator frame would produce a cleaner joint. In opposing this view the practice at the Yale & Towne Mfg. Co., Stamford, Conn., was cited. Here it was said that match plates cast in aluminum under pressure in molds made of a mixture of plaster of paris and asbestos, produced work which brought out minute detail and absolute absence of fins in the completed casting. One man said that he was producing shear castings on match plates without fins. The peculiar curved surface of the thumb and finger rings of shears presents a difficult problem to foundries.

Other discussion centered around the inaccuracy in the use of test pieces. The general experience of the foundrymen present seemed to be that there frequently was a wide variation between the physical property of the test piece and of the casting.

Following the general discussion E. B. Estabrook, Leeds-Northrup Co., Philadelphia, gave an illustrated talk on pyrometer control in melting and casting of nonferrous metals.

Retires from Active Foundry Management

John T. Stoney has been granted his request to be relieved of the details of management of the Ferro Machine & Foundry Co., Cleveland, and will take charge of a department to be constructed and equipped by that company which will be devoted to the development of foundry equipment. During the 20 years that he has been associated with that company, Mr. Stoney has developed molding and core machines as well as other foundry equipment and methods for producing automobile cylinder castings, and it is thought that this work may be carried on more satisfactorily in a separate department. Mr. Stoney will continue as first vice president and also a member of the board of directors and executive committee. Mr. Stoney's son, Raymond E. Stoney, will be manager of the foundry division of the company and Henry B. Myers will be manager of the machine shop division. The results of the investigations of Mr. Stoney will be made available through the Stoney Foundry Engineering & Equipment Co., Cleveland, of which he is president.

Made District Manager

H. J. Clark has been made district manager of the Bayley Mfg. Co., Milwaukee, with offices at 523 Penton building, Cleveland. For the past three years Mr. Clark has been district manager of the B. F. Sturtevant Co. in Cleveland and previously was associated with the same firm in St. Louis, Kansas City and Chicago.

J. W. Foster has been appointed district sales manager with headquartres at Baltimore of the Linde Air Products Co., New York. Prior to this appointment Mr. Foster was salesman in the Pittsburgh district.

Form New Company

The Detroit Aluminum & Brass Corp., Detroit, has been organized with a capital stock of $250,000, J. P. Carritte being president and treasurer and L. G. Hooker vice president and secretary. Mr. Carritte organized and for a number of years operated the McAdamite Aluminum Co., and also was a director of the General Aluminum & Brass Mfg. Co. Mr. Hooker was connected with General Aluminum & Brass Mfg. Co. since its inception and for 12 years was treasurer and a director. Philip J. Fobert will be production manager of the bearing division, Paul Coskey in charge of babbitting operations, William M. Cooper chief engineer and J. P. Carritte Jr. assistant foundry superintendent and metallurgist. The company will occupy the plant formerly owned by Graham Bros. which has over 45,000 square feet of floor space and 2½ acres of ground. The plant is being equipped with modern machinery to manufacture bronze-back, babbit-lined motor bearings, and brass, bronze and aluminum castings.

Accepts New Position

Walter V. Berry has resigned his position as sales and foundry engineer for the Lava Crucible Co., Pittsburgh, to become manager of the Metal Improvement Co., Cleveland. On completing his scholastic training in chemistry and metallurgy a number of years ago, Mr. Berry became connected with the Keystone Bronze Co., Pittsburgh. Later he was district sales manager for the Pennsylvania Products Co., Portland, Me., until during the war when he assisted in the organization of the Berry Metal Co., New Brighton, Pa. The main product of the latter company was a tinless bronze for use in mill bearings. Later the Berry Metal Co. combined with a number of other firms to form the Ideal Foundry & Machine Co., Beaver Falls, Pa., where Mr. Berry was in charge of the foundry departments. He became associated with the Lava Crucible Co. in 1923.

Foundrymen Meet

At the regular monthly meeting of the Pittsburgh Foundrymen's association held at the General Forbes hotel, May 18, the officers for the ensuing year were elected as follows: President, William K. Frank, the Damascus Bronze Co.; vice president, L. V. Stevens, the Locomotive Stoker Co., and secretary-treasurer, William J. Brandt. The following were elected to serve upon the executive committee: Ralph W. Jones, the Union Switch & Signal Co.; Thomas A. Reynolds, the McConway-Torley Co.; E. D. Frohman, S. Obermayer Co.; James Jones, the Pittsburgh Valve Foundry & Construction Co.; and C. D. Carey, Verona Steel Casting Co.

Book Review

Metal Statistics, 1925, eighteenth annual edition, 536 pages, cloth 4 x 6 inches, published by the American Metal Market and Daily Iron and Steel Report, New York—and supplied by THE FOUNDRY, Cleveland—price $1.00 net.

This 1925 edition contains the same general statistical information concerning ferrous and nonferrous metals that has been supplied in previous years, but various new tables have been introduced. The aim each year is to furnish statistics providing the information most generally required by producers and consumers, buyers and sellers of metals and iron and steel products.

Attention is directed to the fact that the prices given in this volume represent wholesale selling prices.

All the iron and steel production statistics are gathered by the American Iron and Steel institute, while the production statistics on metals are for the most part based on figures furnished by the United States geological survey and the American bureau of metal statistics.

Opens Sales Office

The W. W. Sly Mfg. Co., Cleveland, has opened an office at 215 Security building, 44 Vernon street, Springfield, Mass., under direction of Daniel L. Harris. Mr. Harris was educated at Dartmouth and Yale colleges and formerly was assistant salesmanager of the W. W. Sly Mfg. Co.

Changes Eastern Office

The New York office of the Austin Co., Cleveland has been removed to the Equitable building, 120 Broadway, New York. J. K. Gannett is district manager of the eastern office with A. D. Engle and D. C. Raymond as assistants.

Move Western Office

The office of the Sullivan Machinery Co. at Dallas, Tex., has been removed from the Western Indemnity Bldg., to rooms 522-523 Santa Fe Bldg. David H. Hunter is manager.

J. P. Case has been appointed sales manager of the Brown Hoisting Machinery Co., Cleveland, in charge of Cleveland division sales.

Refining Metal Electrically

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en in the ordinary manner and poured into a sand mold, the best size being a 1-inch square bar, 6 inches long, cast on end. From the appearance of the metal as it pours over the lip of the spoon, and from the appearance of the fracture of this test piece, the quality and temperature of the metal is judged. As soon as the metal gives a soft appearing fracture, coupled with the bluish color when pouring, the metal is in proper condition to tap. On heats of iron which are extremely hot, the metal when poured will be accompanied by short blue flames shooting from the stream, exactly the same as on a hot steel heat.

The required additions of alloys should be made as soon as a fair temperature is attained so that any of the constituents entering the slag may be reduced into the metal, and diffused before the furnace is tapped.

Such a heat will be accompanied into the ladle by this basic slag which is difficult to handle. It is so fluid that any attempt to skim while pouring is futile. Lime added will thicken the slag on the surface but a considerable quantity of the slag will remain under the surface. This slag will run into the mold if any attempt is made to pour it in this state. Incidentally, this additional amount of lime will prove to be rather expensive. There are three main solutions to this problem. These are the use of a bottom pour ladle; the use of a tea spout ladle; or pouring from the furnace ladle into another, keeping the greater portion of the slag in the former. During the pouring, the small amount of slag which remains with the metal may be skimmed. The choice of these methods will depend upon the opinions of the supervisory forces in the various foundries, and needs no discussion at this time.

Appoint Representative

The Dings Magnetic Separator Co., Milwaukee, has established offices at 725 Live Stock Exchange building, Kansas City, Mo. and has appointed Mr. Hackman as sales representative for Kansas and western Missouri.

Change Branch Name

At a recent meeting of the Ohio State Foundrymens association in Toledo, O., the name of the local branch was changed from the Toledo Founders' & Metal Trades association to the Toledo Foundries association.

Equipment Sales Are Heavier

Report of Department of Census Shows Substantial Increase in Sales Was Realized in March—Inquiries Extant Justify Greater Buying Movement

AFTER cutting first estimates on the year's business, which were made late in 1924 when predictions of boom times in 1925 were prevalent, manufacturers of foundry equipment are finding the business closed thus far this year reaching a satisfactory total. Many plants are working at a fairly high percentage of capacity, one manufacturer of equipment reporting business closed thus far this year in excess of that closed for the corresponding period in 1924, another stating the sales in March were in greater volume than for any month in several years, and yet another planning additions and extensions to his manufacturing facilities. However, sales are not as heavy as would be expected, considering the large number of inquiries now current. Foundrymen seem anxious to gather information on new equipment, but many hesitate on closing until greater improvement is noted in the foundry operating rate.

Unfilled orders for foundry equipment on April 1 indicated a substantial increase in value over those reported on March 1, according to the bureau of census. The value of unfilled orders in April was $545,540 as compared with $446,395 on March 1. Sales during March totaled $469,325 as compared with $326,887 in February and $387,579 during March 1924. Shipments in March amounted to $346,590, a gain from the value of $277,856 reported in February.

Lacks Strong Buying Incentive

THAT the foundry equipment industry has room for much improvement generally is conceded, but it is the concensus of opinion that a considerably bettered condition was enjoyed in May than in April in the Pittsburgh territory. Throughout April a marked slump of inquiries and orders was noted, while in May orders were more numerous. For the most part the orders developed on new inquiries rather than on older projects, action on many of which still is deferred. Orders for molding machines are more numerous, the Herman Pneumatic Machine Co., Zelienople, Pa., reporting the receipt of one order for three large rollover machines from the American Radiator Co., Buffalo; one for two from the General Electric Co., Lynn, Mass., and several for one each including the Magnus Co., Inc., Topeka, Kan., the Wheeler Condenser & Engineering Co., Cartaret, N. J., and the Lebanon Steel Co., Lebanon, Pa. Another seller of foundry equipment here has three inquiries for two molding machines each from nearby foundries. A Butler, Pa. foundry has purchased a steel plate insulated core oven, together with a motor-driven blower. A Pittsburgh district foundry is negotiating for a cupola and at least two plants are obtaining quotations on sand separators. A few orders for vibrators come in every few days and one buyer recently placed an order for six. The Hubley Mfg. Co., Lancaster, Pa., has purchased sand-blast equipment and the Howard Stove Co., Beaver Falls, Pa., has secured dust arrester equipment from the Pangborn Corp., Hagerstown, Md. Shipment is being made of a tumbling mill recently ordered by the Westinghouse Electric & Mfg. Co., East Pittsburgh. This interest recently closed on a 5-ton head-room trolley with the Northern Engineering Works, Detroit. Crane inquiries from foundries are at a low ebb although the New Westcott Pump & Valve Co., East St. Louis, ordered a 3-ton, 2-motor crane from the Whiting Corp., Harvey, Ill. The Atlas Sanitary Mfg. Co., Zelienople, Pa., which has acquired a 50-acre site there, will soon be in the market for equipment, and the United Engineering & Foundry Co., Pittsburgh, may purchase some additional equipment for expansion at its Frank Kneeland works.

New England Sales Better

INQUIRY for foundry equipment in New England has shown more life during the last few days than at any time in a month or more. Recent sales have been far from heavy but it appears that the May total was appreciably in excess of the business in April. A Worcester, Mass., foundry is in the market for an electric annealing oven and several Connecticut foundries are looking for equipment, one for a moderate list of molding machines. The Singer Sewing Machine Co., Elizabethport, N. J., has just purchased a sand separator from the Royer Foundry & Machine Co., Wilkes-Barre, Pa. A Massachusetts textile machine manufacturer bought four molding machines and miscellaneous small equipment. The improvement in sales is attributed to the rate of melt in New England which shows moderate improvement.

Eastern Demand Spotty

DEMAND for foundry equipment in the New York district continues spotty. May, ordinarily a busy month, brought comparatively little in the way of actual business, and little from the standpoint of inquiry. Lack of new building projects and continued low operations at the jobbing foundries is reflected throughout. Recent buyers include the Richardson & Boynton Co., Dover, N. J., and the Hillsdale Plow Co., Hillsdale, N. Y., both buying cupolas. It is understood the business in these instances went to the Whiting Corp., Harvey, Ill. The Standard Gas Equipment Corp., Baltimore, has purchased sand-blast and dust arrester equipment from the Pangborn Corp., Hagerstown, Md. The Carteret Foundry Co., Jersey City, N. J., sashweight founder, is figuring on a cupola, tumbling barrels and other equipment for a foundry it is understood to have purchased from Louis Sacks, Newark, N. J., at Bolton, N. J. The Lycoming Foundry Co., Wililamsport, Pa., is planning an 80 by 200-foot foundry addition, for which a substantial amount of equip-

ment likely is to be required. Some equipment will be required by William T. Bate & Son Inc., Conshohocken, Pa., which has acquired the former foundry of the Hummel Foundry Co. for the production of iron, steel and alloy castings. One large seller of a miscellaneous line, points to sand cutters as the most active item on the list.

Cleveland Inquiries Good

MANY inquiries for foundry equipment are extant in the Cleveland territory, although the activity is not general. Manufacturers of several lines report sufficient orders to keep their plants running at a fairly high rate of capacity, while others are finding business slack. Buyers continue to hesitate on placing orders, evidently waiting for further improvement in the foundry industry. The Keystone Iron & Steel Works, Los Angeles, has closed on sand mixing equipment from the Standard Sand Machine Co., Cleveland. A core knockout machine has been purchased by the Waterloo Gasoline Engine Co., Waterloo, Ia., shakeout bails by the Cadillac Motor Car Co., Detroit, and the Cleveland Co-Operative Stove Co., Cleveland, and vibrator and shakeout equipment by the Worthington Pump & Machinery Corp., Cincinnati, the Westinghouse Air Brake Co., Wilmerding, Pa., the Griffin Wheel Co., Detroit, the Nash Motor Co., Kenosha, Wis., the Standard Foundry Co., Racine, Wis., and the Modern Foundry Co., Cincinnati, from the Stoney Foundry Engineering & Equipment Co., Cleveland. The Treadwell Engineering Co., Easton, Pa., the Albany Malleable Iron Co., Voorheesville, N. Y., the Crucible Steel Castings Co., Pembrook, Pa., the Anderson Gas Engine & Foundry Co., Andesron, Ind., the Semi-Steel Castings Co., St. Louis, the Athens Stove Co., Athens, Tenn., have purchased tumbling mills and dust arrester equipment from the W. W. Sly Mfg. Co., Cleveland. The Semi-Steel Castings Co. also has purchased sand-blast equipment from the same manufacturers. The Eberhard Mfg. Co., Cleveland has closed on sand-blast equipment from the Pangborn Corp., Hagerstown, Md.

Chicago Sales Lag

FOUNDRY equipment sales are not being closed in this district as rapidly as the volume of inquiry would seem to warrant. A spotty condition characterizes the foundry industry, with the foundries on automotive work in good position. The National Engineering Co., Chicago, has sold sand mixers in the Machined Steel Castings Co., Alliance, O., and the Manufacturers Foundry Co., Waterbury, Conn. The Maytag Co., Newton, Ia., has purchased sand-blast and dust arrester equipment, the American Car & Foundry Co., Detroit, has closed on sand-blast equipment and the Packard Motor Car Co., Detroit, has secured dust arrester equipment from the Pangborn Corp.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Standard Sanitary Mfg. Co., Pittsburgh, is planning an addition.

Bessemer Gas Engine Co., Grove City, Pa., will build two additions each 60 x 180 feet.

Plano Foundry Co., Plano, Ill., is having plans prepared for a large addition to its plant.

Lycoming Motor Co., Williamsport, Pa., is having plans drawn for a 1-story addition to its foundry, 80 x 200 feet.

Work has been started on the foundry of the Liddlestown Hardware & Foundry Co., Littlestown, Pa. *Noted April* 15.

Western Furnace & Mfg. Co., 600 North Terry street, Seattle, is planning a foundry to cost approximately $25,000.

F. M. Flander has started a foundry at Owosso, Mich., to manufacture brass and aluminum castings.

Plant of the Hummel Foundry Co., Conshohocken, Pa., idle for some time, has been taken over by William T. Bate & Son Inc., and will be improved and enlarged.

Fritzell Foundry, Inc., Wilmington, Del., has been incorporated with capital stock of $200,000 to carry on a general foundry business.

H. P. Denscher Co., Hamilton, O., will build an addition to its foundry on Seventh and Monroe streets, 23 x 60 feet and one and two stories high. Otto Ehresman is president.

Mikesell Pattern Works, Vernon, Calif., is erecting a new building on West Twenty-seventh street near the Santa Fe railroad. J. C. Mikesell is manager.

Pechstein Iron Works, Keokuk, Ia., has been sold to A. W. Hulson for $25,000, and is expected to be operated by the Hulson Grate Co., manufacturer of grates.

American Locomotive Co., 30 Church street, New York, has awarded a contract for the erection of a plant addition at Schenectady, N. Y., including a sand-blast shop and tank plant.

Bodine Pattern Co., St. Louis, has leased a plant at 1611 Cass avenue and will remodel it for the production of metal and wood patterns.

International Foundry & Equipment Co., Columbus, O., has been incorporated with $30,000 capital by Harry M. Runkle, Charles E. Firestone, O. E. Stevenson, E. C. Meredith and J. L. Adkinson.

The Moran Co., Kerchoff building, Los Angeles, Calif., has prepared plans for a 1-story building, 80 x 200 feet, including a foundry, for the American Can Products Co., San Diego, Calif.

M. & N. Valve & Fittings Co., Anniston, Ala., has been incorporated with $175,000 capital to manufacture pipe fittings and valves. J. W. Conway, Atlanta, Ga., is president. A plant will be erected at once.

Berkeley Brass Foundry Co., 2629 Seventh street, Berkeley, Calif., is constructing an addition to its plant which will add 2000 square feet to its plant. Walter Eggers is manager.

Detroit Aluminum & Brass Corp., Detroit, has been incorporated with $25,000 capital to manufacture metal products by Lloyd G. Hooker, John P. Carritte Jr., and John P. Carrotte, 112 Edison avenue.

Pontiac Pattern & Engineering Co., Pontiac, Mich., has been incorporated with $25,000 capital to operate a manufacturing and engineering business by John W. Wilbur, Max C. Rutzen, and Albert Weber, 183 East Iroquoir road.

General Die Casting & Machinery Co., Chicago, will be moved to Benton Harbor, Mich., shortly and a plant established there. The Benton Harbor Malleable Foundry Co., Benton Harbor, will be reorganized and the two companies combined.

American Laundry Machine Co., Buffalo road, Rochester, N. Y., has awarded a contract for a 3-story addition 130 x 150 costing approximately $80,000. Headquarters of the company are at Norwood station, Cincinnati. *Noted May* 1.

Wilson Foundry & Machine Co., Pontiac, Mich., has announced an expansion program on which work has been started. Additional floor space of 172,000 square feet will be provided and a motor assembly building 3 stories high will be erected.

Edward Helmke, 802 South Eight street, Wausau, Wis., is the head of a company being organized to build and operate a machine shop. Wausau Iron Works is preparing plans and a contract will be awarded soon. Inquiry has been made for a cupola, crane, and some machine shop equipment.

Work recently was started on the new foundry of the Beans Foundry Co., Martins Ferry, O. The building is to be 150 feet long and 75 feet wide and cost $75,000. The entire building will be devoted to foundry work, the offices remaining in the building now in use. *Noted March* 1.

The FOUNDRY

SELLING THE OUTPUT

The FOUNDRY

What The Industry Needs Today Is Sales Not Production

Scrimping on Sales Expense Is Like FASTING TO GROW FAT

I READ a newspaper story the other day that gave a new slant on the matter of paying salesmen. An eastern foundry made an agreement with a sales representative offering him a commission for selling its output. This fellow must have been of high pressure, heavy hitting, big league caliber for his commissions in less than a year totaled well over $20,000. The company terminated his contract abruptly and the news yarn had to do with the suit brought by the agent for damages. Of course, all of the facts are not at hand, but it would seem that the commission offered was out of accord with the value of the service rendered. On the other hand, the action of the company in breaking the contract may have been open to question.

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TOO many firms fail to recognize as a legitimate expense any money spent in marketing their products. Salesmen, in particular, often are regarded as unworthy of their hire. You know how it is, the old feeling between the operating man and the one who sells his work, intensified by the added factor of an owners interest in keeping down expenses. A salesman should be paid sufficient to provide for his living and business expenses and something besides; and then made to earn his keep. If he is paid a salary it should be enough to permit him to be self respecting. Probably the best plan for paying a salesman is one which will give him some added incentive toward increased results. Commissions usually are satisfactory, unless conditions are such that a living can not be made by this plan. A bonus, based upon increased business is regarded by many managers as being even better.

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PICKING a salesman, or in case of a small foundry, a broker or representative, is not always an easy job. Even those who employ large numbers of the tribe often find their judgement wrong in individual cases. The best castings salesmen that I know have all been foundrymen, and while it is not imperative that a man should run a shop before he starts to sell its output, such preparation is undoubtedly valuable. Of course, as the vaudevillian remarked, "Henry Ford might not make a good president even though he has the makin's of another Lincoln." Nevertheless, if a man knows how castings are made he is a better salesman.

P. T. Barnum Says!

THERE are many who think that economy consists in saving cheese-parings and candle ends, in cutting off two pence from the laundress' bill and doing all sorts of little, mean, dirty things.

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AFTER a man is employed he should be backed to the limit. Nothing will kill the interest and ability of a salesman quicker than an instance such as I heard about recently. A young man had secured an order for a firm with which he had a brokerage contract. His company rejected the order on some technicality and then sent a man from the plant who took the job at a slightly lower price and thus saved the commission which *should* have gone to the broker. That is what P. T. refers to in his text on cheese parings. A good salesman is entitled to prompt expression of appreciation from the management when he has done his work well. Don't be like the little 8 year old boy who was given a sled for Christmas by some charitable minded friend. The kid wrote a note to his benefactor just the other day saying:

"Deer Sir, i am bill Adams the guy that got the sled and I have ben to dam busy playing with it to write and thank you before but now the snow is all gone and i have got time so i thank you onest more." Bill Adams.

Phineas, Jr